Central Coast Juvenile Herring Survey, August 2011

M. Thompson, C. Fort, and T.W. Therriault

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
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CENTRAL COAST JUVENILE HERRING SURVEY, AUGUST 2011

by

M. Thompson, C. Fort, and T.W. Therriault

Fisheries and Oceans Canada
Science Branch, Pacific Region
Pacific Biological Station
Nanaimo, British Columbia
V9T 6N7

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ABSTRACT

Thompson, M., Fort, C., and Therriault, T.W. 2015. Central Coast juvenile herring survey, August 2011. Can. Manuscr. Rep. Fish. Aquat. Sci. 3071: vi + 53 p.

In 2011, a Central Coast juvenile herring survey was conducted from August 8-19. Fifty-eight sets were made at 13 locations within Statistical Management Areas 6, 7, 8 and 9. The study area extended from Meyers Passage in the north to Rivers Inlet in the south. The survey serves to address information gaps on the distribution, abundance, size and feeding habits of juvenile herring in these nearshore, northern waters.

Twenty species of fish were identified in all purse seine catches with Pacific herring (*Clupea pallasi*) being the most frequently encountered species. A total of 4090 herring were measured resulting in a length frequency distribution that was distinctly bimodal representing age-0+ and age-1+ fish. Age-0+, age-1+, and age-2+ or older herring occurred in 89.70%, 79.30%, and 31.00% of the sets, respectively. Two oblique plankton tows were performed at each of the 13 locations resulting in a total of 26 tows during the survey. *Acartia longiremis* and larval euphausiids (*Euphausia pacifica, Thysanoessa spinifera, Thysanoessa longipes, Thysanoessa inspinata*) occurred in all samples. More than 50% of all plankton biomass captured was *Acartia longiremis*, eggs (mainly euphausiid) and *Centropages abdominalis*.

RÉSUMÉ

Thompson, M., Fort, C., et Therriault, T.W. 2015. Évaluation du stock de hareng juvénile de la côte centrale, août 2011. Can. Manuscr. Rep. Fish. Aquat. Sci. 3071: vi + 53 p.

En 2011, une évaluation du stock de hareng juvénile de la côte centrale a été réalisée du 8 au 19 août. Cinquante-huit groupes ont été établis à 13 emplacements dans les zones de gestion statistique 6, 7, 8 et 9. La région visée par l'étude s'étendait du passage Meyers dans le nord jusqu'au bras de mer Rivers au sud. L'étude visait à combler les lacunes en matière d'information relative à la répartition, l'abondance, la taille et aux habitudes alimentaires des harengs juvéniles dans ces eaux littorales et nordiques.

Vingt espèces de poisson ont été identifiées dans toutes les prises à la senne coulissante, le hareng du Pacifique (*Clupea pallasi*) étant l'espèce capturée le plus fréquemment. Au total, 4 090 harengs ont été mesurés et on a observé une répartition de la fréquence des longueurs nettement bimodale représentant des poissons d'âge 0+ et 1+. Des harengs d'âge 0+, 1+ et 2+ ou plus âgés ont été observés dans 89,70 %, 79,30 % et 31 % des groupes, respectivement. Deux traits obliques de plancton ont été réalisés à chacun des 13 emplacements, ce qui donne un total de 26 traits durant l'étude. Des *Acartia longiremis* et des euphausiacés larvaires (*Euphausia pacifica, Thysanoessa spinifera, Thysanoessa longipes, Thysanoessa inspinata*) ont été observés dans tous les échantillons. Plus de 50 % de la biomasse totale du plancton capturé étaient composés d'œufs d'*Acartia longiremis* (principalement des euphausiacés) et de *Centropages abdominalis*.

INTRODUCTION

Pacific herring (*Clupea pallasi*) are an important commercial species and a vital forage fish for many marine mammals, birds and other fish in British Columbia's coastal waters. Herring spawn principally on marine vegetation in the subtidal and upper intertidal zone between February and June, with peak spawning between March and April (Humphreys and Hourston 1978). Larvae hatch in two to three weeks, and disperse with surface currents, metamorphosing into juvenile herring at a length of ~25mm (Hourston and Haegele 1980). Juvenile herring consist of two distinct age classes, age-0+ and age-1+, with recruitment for this species occurring at age 3 when they join the sexually mature spawning population (Hay and McCarter 1999). During daylight hours, juvenile herring congregate in schools, occasionally forming mixed aggregates with other pelagic species, close to shore near the bottom (Haegele 1997). At dusk, these fish migrate into surface waters to feed on plankton. During this time they are vulnerable to purse seine gear.

Relatively little is known about the distribution, abundance, and size of juvenile herring in the Central Coast of British Columbia (Figure 1). In 2002-2004, and 2007-2011 juvenile herring surveys were designed and conducted to address information gaps and learn about the general biology of herring in this northern geographical area. The survey objectives were to estimate relative abundance of juvenile herring and other nearshore pelagic species. This included the collection of morphometric information on fish species caught, estimate of zooplankton density and physical water column properties (temperature and salinity). This survey time series will potentially provide a better understanding of the role and relationships of juvenile herring in Central Coast waters, and may provide an empirical forecast of recruitment to the herring roe fishery based on relative juvenile abundance (Schweigert et. al. 2009), even though the Central Coast roe fishery has been closed since 2008.

METHODS

In 2011, the Central Coast juvenile herring survey was conducted from August 8-19. Fifty-eight sets were made at 13 locations within Statistical Management Areas 6, 7, 8, and 9 (Table 1). The study area included areas between Meyers Passage in the north and Rivers Inlet in the south (Figures 2 and 3). The 2011 set locations were the same as those set out in the 2007 survey, which were refined from the original 2002 survey (Thompson and Therriault 2009, Henderson et. al. 2004). The sampling sites originally were chosen based on known historical herring spawning sites, and represent both nearshore and open water habitats (Haegele and Armstrong 2003).

Fish Sampling

The 12 m, aluminum-hulled Fisheries Research Vessel *Walker Rock* was used for all fishing events. A 183 m long and 27 m deep purse seine net of knotless web, resulting in an area fished of ~2665 m^2, was used for all fishing events. The body of the net had 46 m

of 22.2 mm mesh at the tow end followed by 91 m of 19.0 mm mesh, and the bunt end was 46 m of 9.5 mm mesh. The net fished to a depth of 10 m, and was able to retain fish greater than 20 mm in length. All sets were made after dusk when herring are feeding near the surface. All sets were made "blind" at predetermined set locations. Five sets were completed per night for all locations. For most sets, it was possible to land the entire catch for biological sampling. On occasion, it was not practical to land a large set in its entirety, so sub-sampling was necessary. When sub-sampling was required, a herring bucket was filled with randomly selected fish and retained for biological sampling. Several dipnet samples from various parts of the net (catch) would be used to make up the random sub-sample. The remainder of the set was released over the corkline, its size estimated as the number of buckets released. The number of herring caught in each set was determined by multiplying the sub-sample herring weight and number by the number of estimated buckets released (total catch). The number of other species caught in the sub-sample was determined in the same manner (Table 2). All fish retained for sampling were weighed, bagged and preserved in a 3.7 % seawater formalin solution, with the exception of large predator species (e.g., adult salmon, dogfish and flatfish). These fish were individually weighed and measured in the field. Retained samples were taken back to the Pacific Biological Station for laboratory analysis.

From each set, 100 or more herring from each represented age-class and all other fish species caught were identified, weighed and measured (up to 25 pieces for each species). If the set contained less than 200 herring, then all herring were weighed and measured. Consistent with standard practices, herring were measured to standard length; salmon and sardine to fork length; dogfish, hake and pollock to total length. All other fish species were measured to standard length.

Plankton Sampling

Twenty-six stepped oblique plankton tows were performed during the survey (Figures 4 and 5). Two plankton samples were taken from each location, one sample "nearshore" and the other "offshore or channel". The tows were completed after dusk and immediately before fishing events. Dual 19 cm diameter bongo nets with 350 µm mesh were used for sampling, resulting in 'left' and 'right' bongo plankton samples (only left samples were processed). The bongos were lowered to 20m and raised by an electric winch at a rate of 1m every 15 seconds. A General Oceanics® 2030R model flowmeter was attached to the left bongo to determine the volume of seawater filtered. Volume filtered was calculated using the following equation (McCarter and Hay 2002):

$$\mathbf{V = (A \cdot F \cdot K) / 999{,}999}$$

Where:

V = volume of water filtered through the plankton net (m^3)
A = area of net opening (0.02835 m^2)
F = number of revolutions recorded by the flow meter (m)
K = standard speed rotor constant for 7cm rotor (26,873)

Upon retrieval, the bongo nets were washed with a high pressure deck hose, and the samples preserved in 3.7 % seawater formalin.

In the laboratory, a volumetric splitter was used to reduce the sample size to a point where organisms could be conveniently counted and identified in a counting tray using a stereo microscope under 30X magnification. Sample splitting continued until a target size of roughly 300 organisms was reached (Thompson et al. 2003).

When possible, zooplankton was identified to the lowest taxonomic level. Copepods were identified to species. Densities for all zooplankton species were determined and expressed as number of animals per m^3.

CTD Sampling

To characterize oceanographic conditions in the surveyed area, a total of 26 CTD (conductivity – temperature – density) casts were made using a Seabird SBE 19*plus* (Figures 4 and 5) at the same locations that zooplankton samples were collected. The CTD unit was weighted and lowered over the side of the vessel to within a few meters of the bottom. Descent rate of the CTD was approximately1 m/sec. All CTD data was post-sample processed to align data and only the downcast data is displayed in graphs.

RESULTS

Fifty-eight sets were made during the 2011 survey; three in section 101 (Rivers Inlet), four in section 091 (Fish Egg Inlet), five in section 085 (Kwakshua Channel), five in section 076 (Kildidt Sound), ten in section 067 (Kitasu Bay and Meyers Passage), three in section 077 (East Higgins Pass), ten in section 072 (Powell Anchorage and Spiller Channel), five in section 073 (Hunter Channel), five in section 074 (Thompson Bay), three in section 084 (Burke Channel), and five in section 081 (Dean Channel). All set locations correspond to set locations used in the 2007 Central Coast survey (Figures 2 and 3, Table 1). Two sets were cancelled in Burke Channel (set code 12) due to a large surface current and weather. Two sets cancelled in East Higgins Pass (set code 8) due to weather and large swell. One set cancelled in Fish Egg Inlet (set code 1) due to weather. Two sets cancelled in Rivers Inlet (set code 14) due to weather and surface current.

Twenty species of fish and two invertebrate species were identified in the purse seine catches. The most frequently encountered species (>25% occurrence) included: Pacific herring and capelin (Tables 2 and 3).

Herring

A total of 4090 herring were measured resulting in a bimodal length-frequency distribution. Based on this length-frequency distribution (Figure 6), the length designations for the herring age-classes are:

0+ = herring less than or equal to 81 mm standard length
1+ = herring between 82 mm and 130 mm standard length
2+ and older = herring greater than or equal to 131 mm standard length

Age-0+ herring occurred in 52 of the 58 sets (89.70 % occurrence; Table 3). Table 4 shows the average length and weight for age-0+ herring, and the total herring catch weight at each set location. The mean length and weight of all sampled age-0+ herring (n=2768) was 55 mm and 2.15 g respectively.

Age-1+ herring occurred in 46 of the 58 sets (79.30% occurrence; Table 3). Table 4 shows the average length and weight for age-1+ herring, and the total herring catch weight at each set location. The mean length and weight of all sampled age-1+ herring (n=1223) was 107 mm and 16.34 g respectively.

Age-2+ herring occurred in 18 of the 58 sets (31.00 % occurrence; Table 3). Table 4 shows the average length and weight for age-2+ herring, and the total herring catch weight at each set location. The mean length and weight of all sampled age-2+ herring (n=99) was 140 mm and 38.96 g respectively.

The relationship between length and weight for all sampled herring was determined by fitting a logistic function to the length-weight data (Figure 8). Burke Channel, Meyers Pass and East Higgins Pass sets resulted in the least amount of herring caught in relation to total catch. Fish Egg Inlet, Rivers Inlet and Spiller Channel sets resulted in the highest amount of herring caught (Table 2 and 4).

Plankton

There were 24 categories of organisms identified in 26 plankton samples (Tables 5 and 6). An average of 11.5719 m^3 of water was filtered per plankton tow. *Acartia longiremis* copepod and larval euphausiids occurred in all samples. *Acartia longiremis*, larval euphausiids, *Pseudocalanus sp.* and medusae occurred in >90 % of samples (Table 7). More than 50% of all plankton biomass captured was *Acartia longiremis*, eggs (mainly euphausiid) and *Centropages abdominalis*.

CTD

Two CTD casts were performed at each location before plankton sampling. The CTD provided a range of data for temperature (^{o}C), salinity (S/m) and depth (m) (Figure 9). In most casts, a thermocline is present within the first 10m of the water column. Salinity is shown to be most variable within this 10 – 20m of the water column. CTD data is only available for years 2007, 2008, 2009 and 2011.

CONCLUSIONS

Fifty-eight stations were sampled resulting in 20 different fish species being recorded from the purse seine sets. A total of 4090 herring were measured and weighed creating a distinct bimodal histogram representing two juvenile herring age groups. Twenty-six plankton tows were performed with all plankton samples being processed. This resulted in *Acartia longiremis* and larval euphausids occurring in all samples and *Acartia longimeres*, eggs (mostly euphausiid) and *Pseudocalanus sp.* showing up in the largest biomass.

ACKNOWLEDGMENTS

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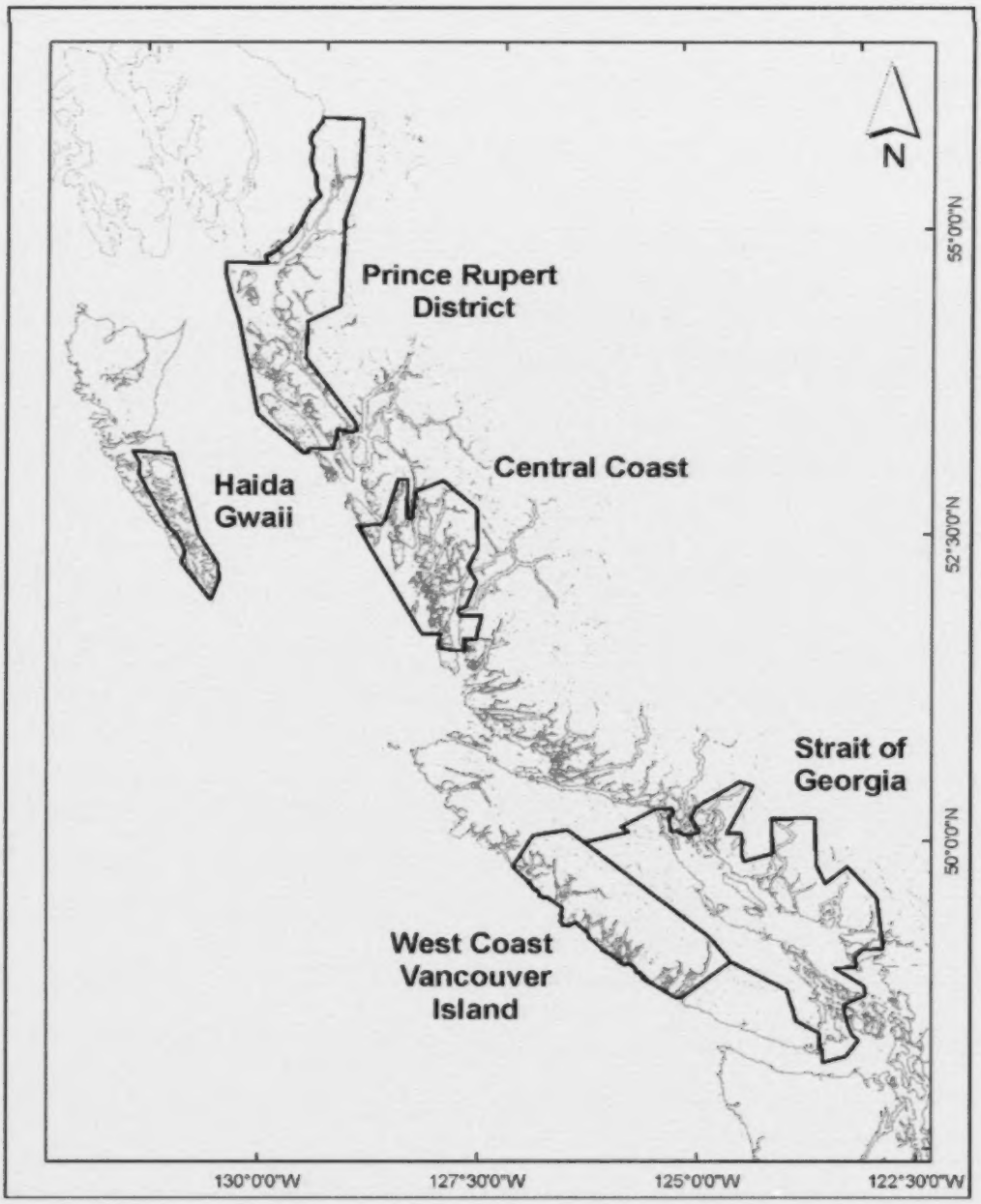


Figure 1. The five major British Columbia herring stock assessment areas.

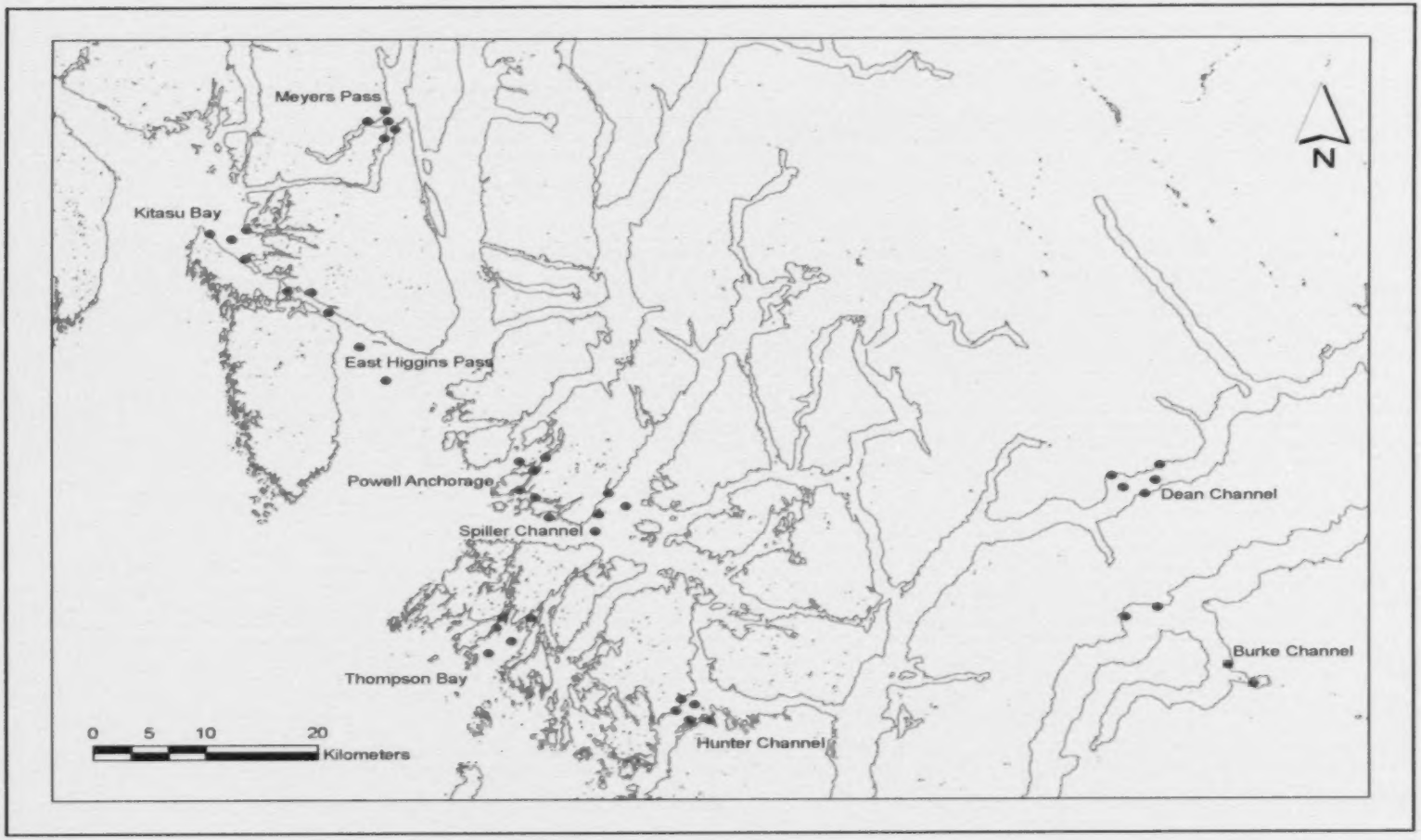


Figure 2. Upper Central Coast purse seine set locations for the 2011 juvenile herring survey.

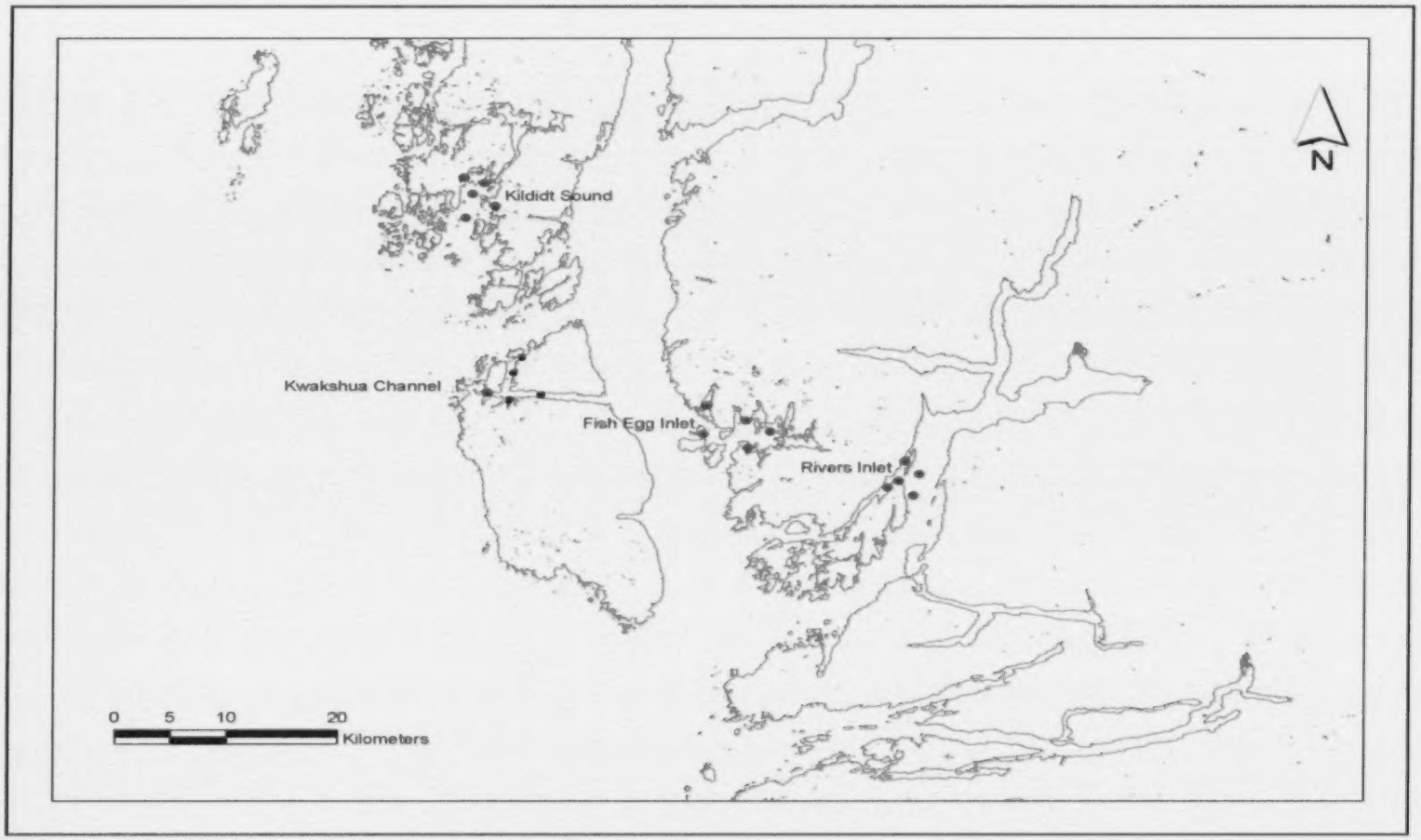


Figure 3. Lower Central Coast purse seine set locations for the 2011 juvenile herring survey.

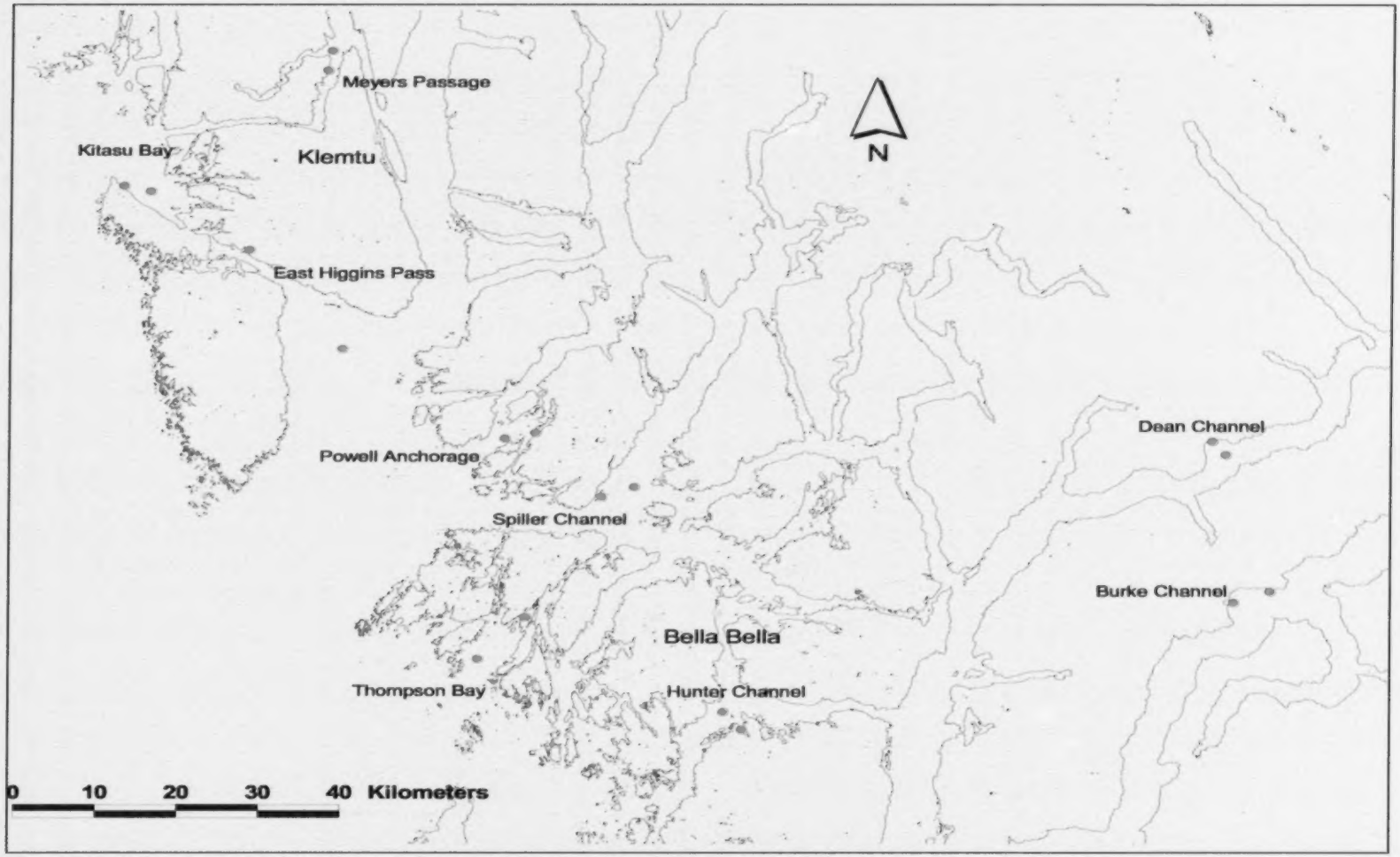


Figure 4. Upper Central Coast plankton set and CTD cast locations for the 2011 survey.

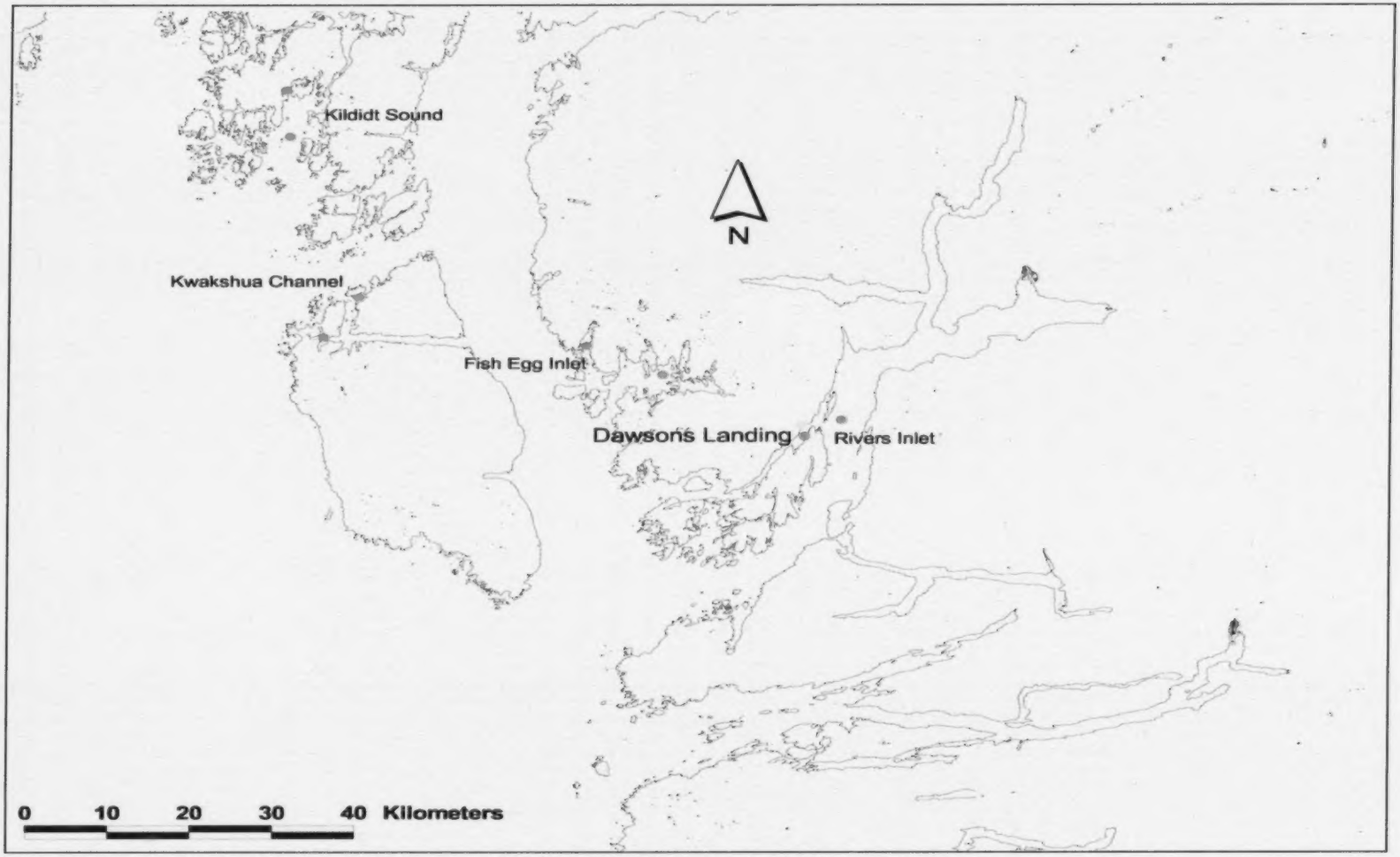


Figure 5. Lower Central Coast plankton set and CTD cast locations for the 2011 survey.

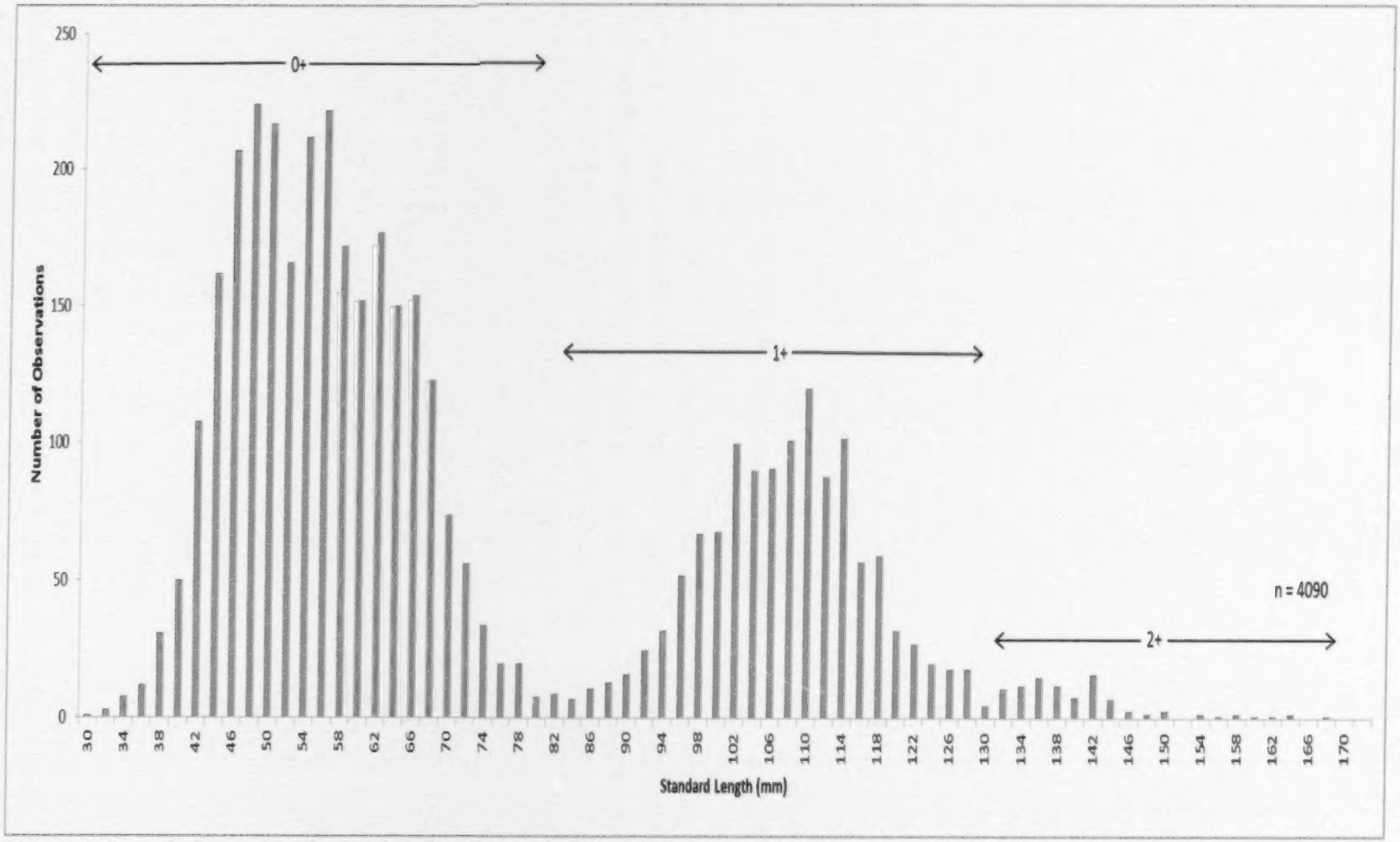
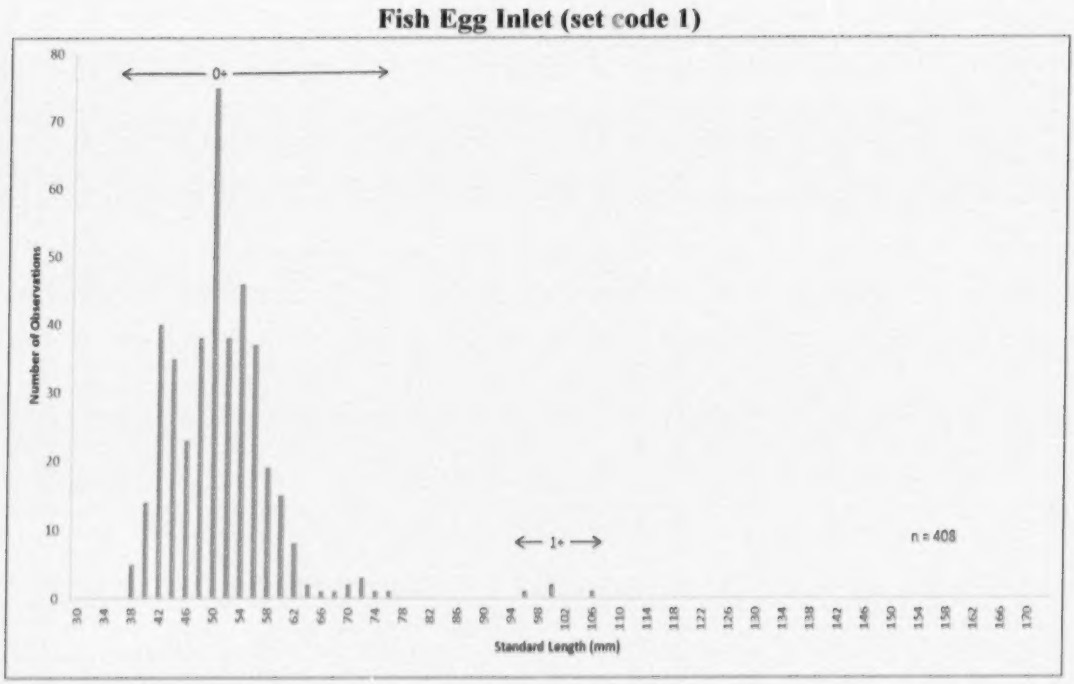


Figure 6. Length-frequency distribution for all sampled herring from the 2011 Central Coast juvenile herring survey.



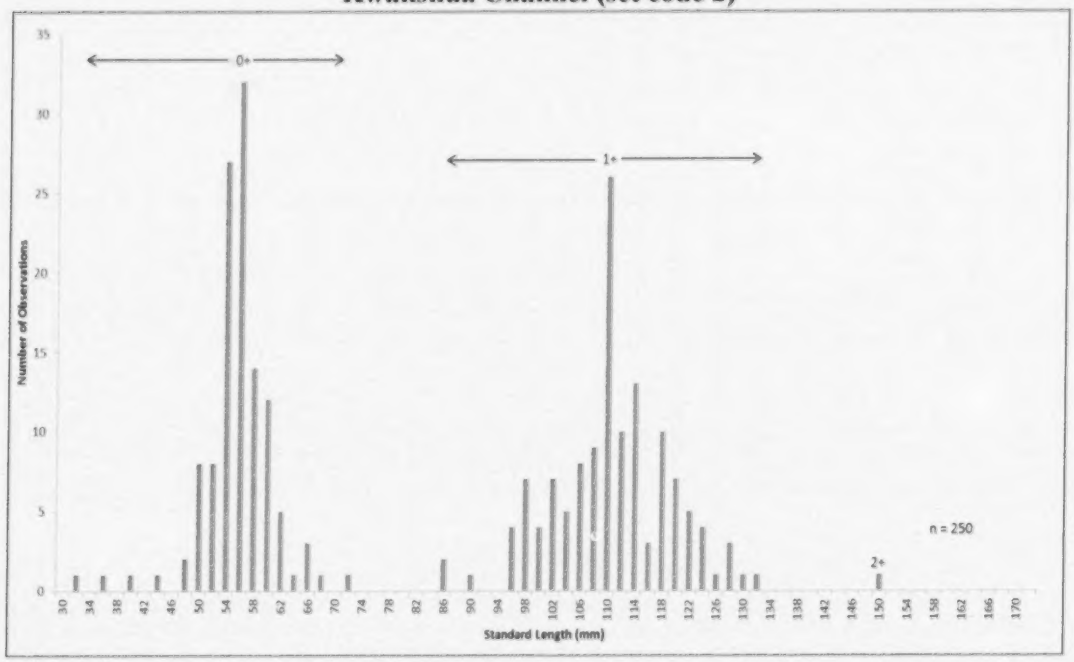
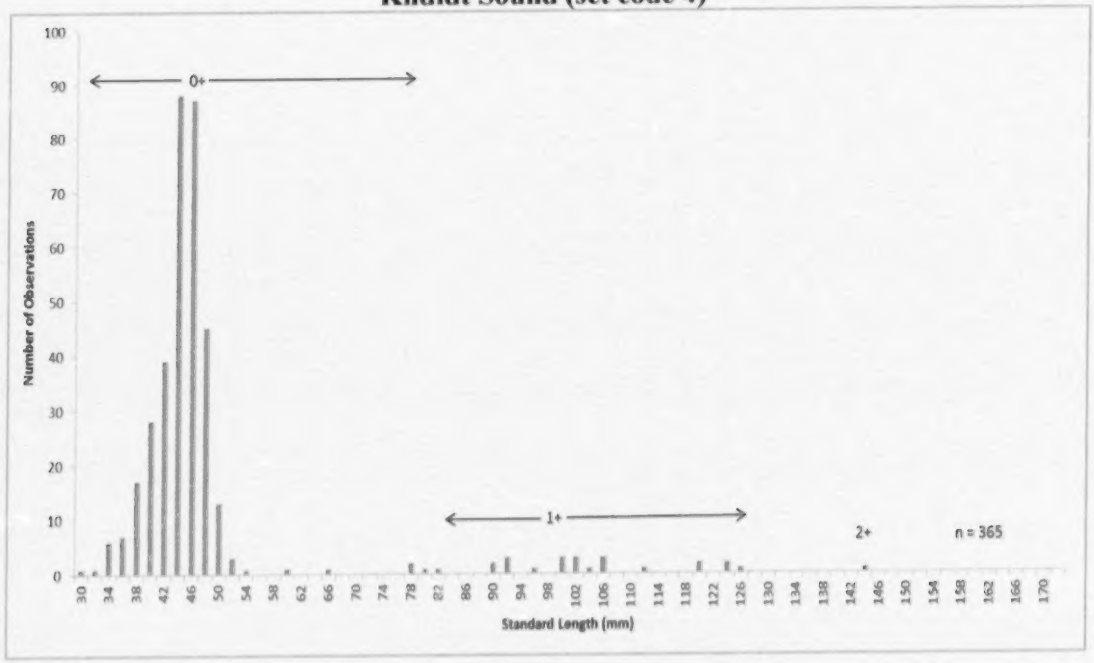


Figure 7. Length-frequency histograms by location (set code) for the 2011 Central Coast juvenile herring survey.



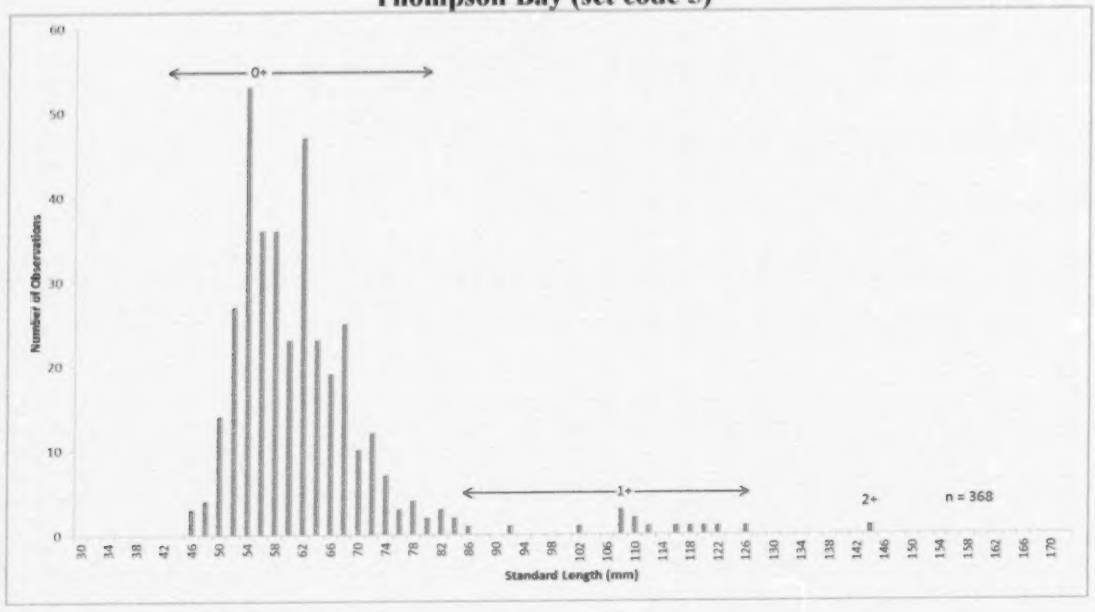
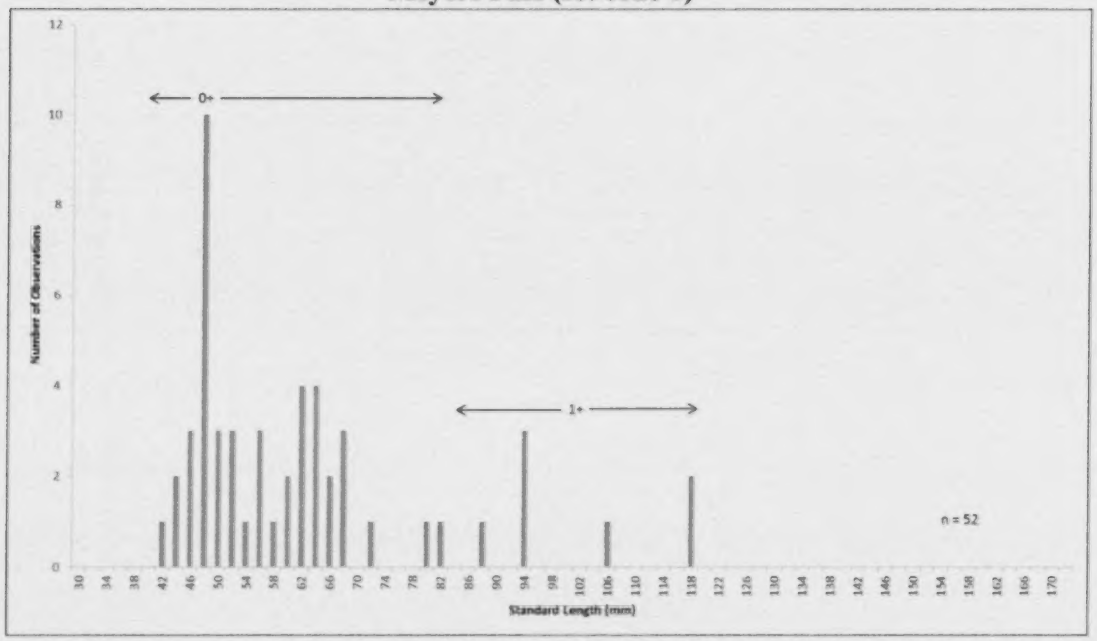


Figure 7…continued

Meyers Pass (set code 6)



Kitasu Bay (set code 7)

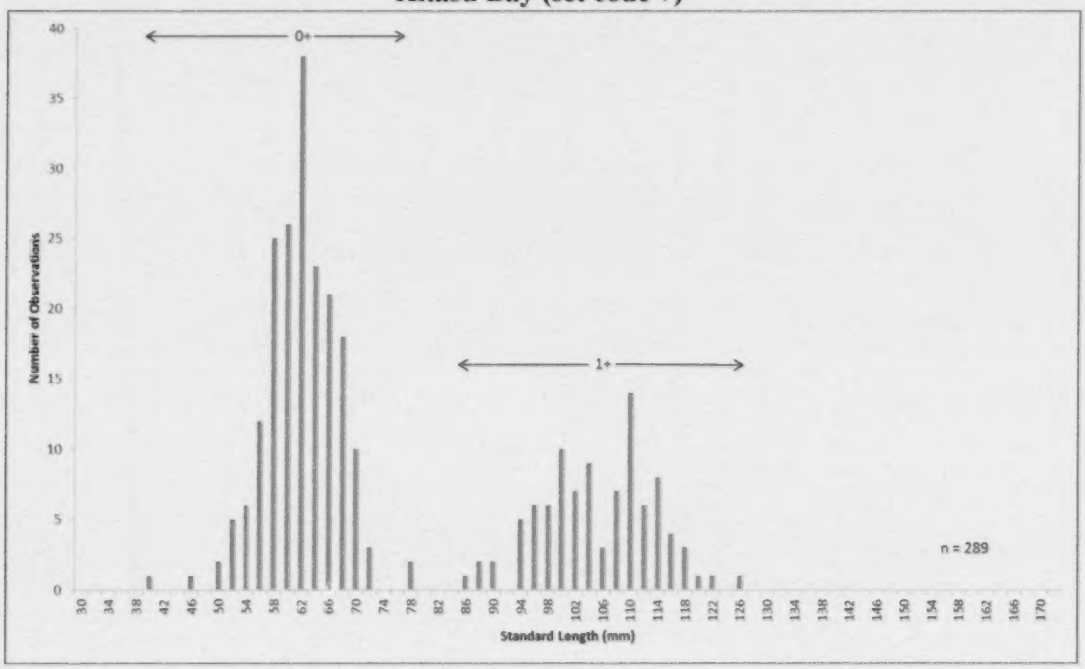
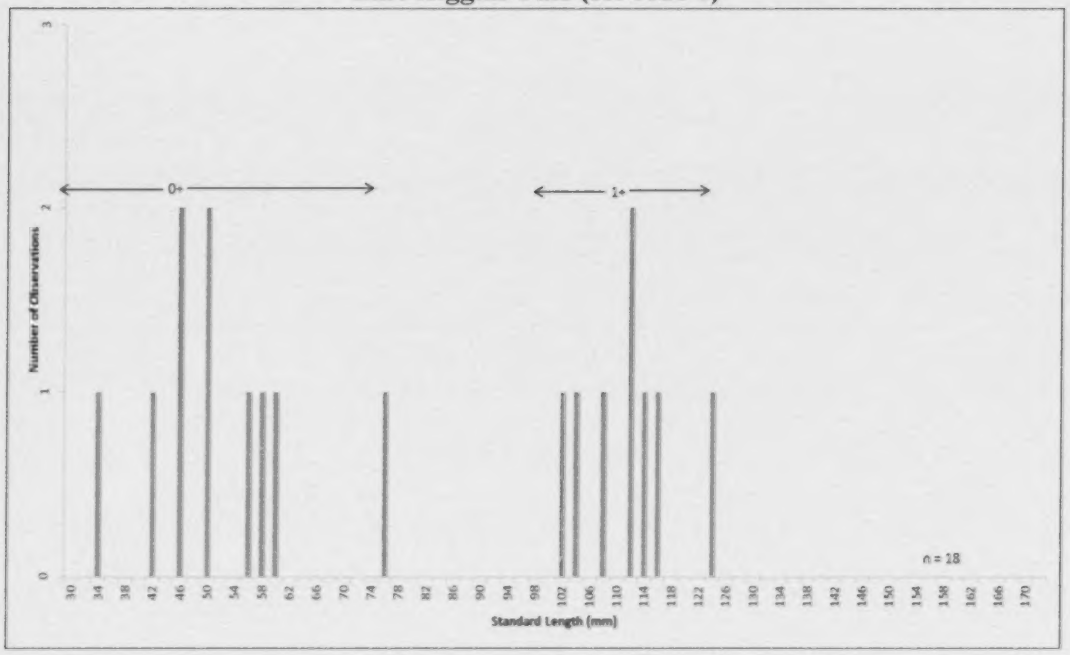


Figure 7…continued

East Higgins Pass (set code 8)



Powell Anchorage (set code 9)

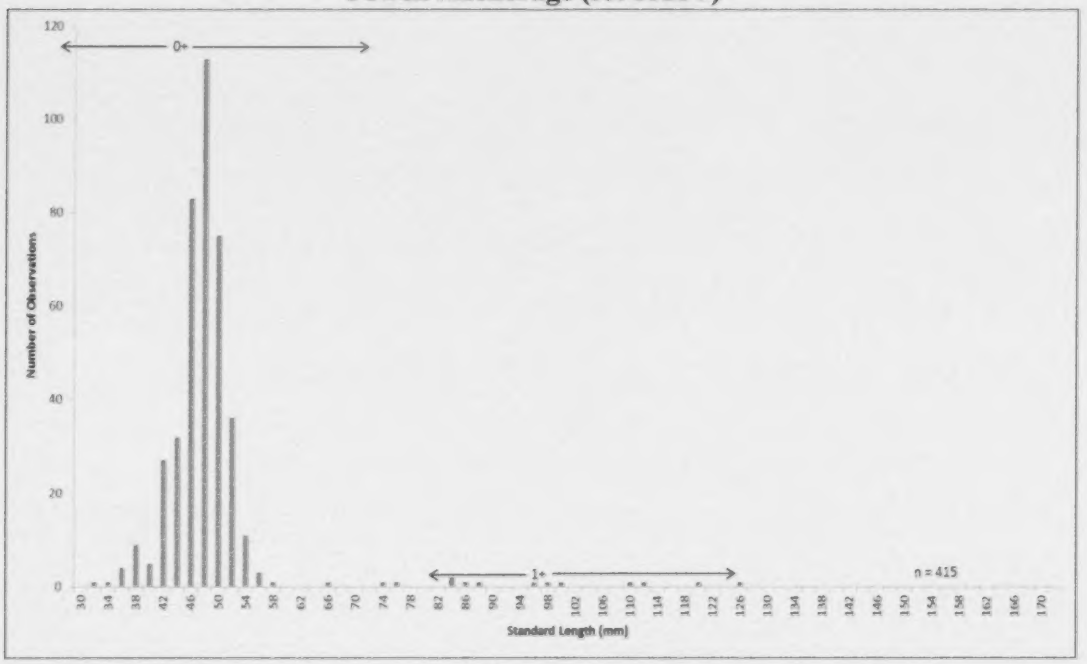
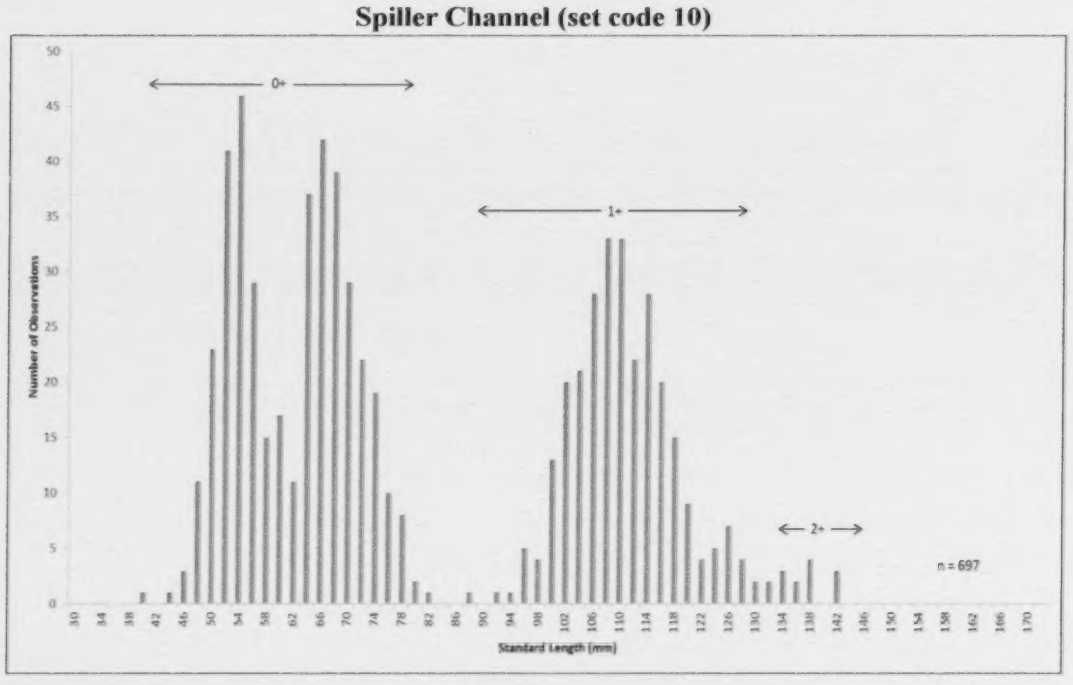


Figure 7…continued



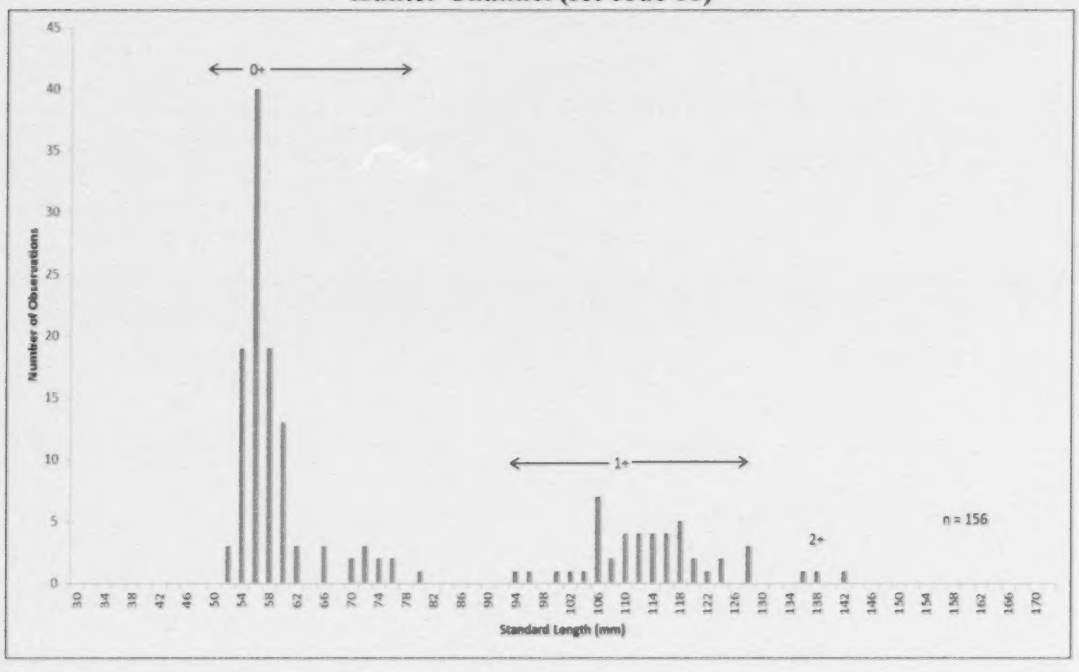
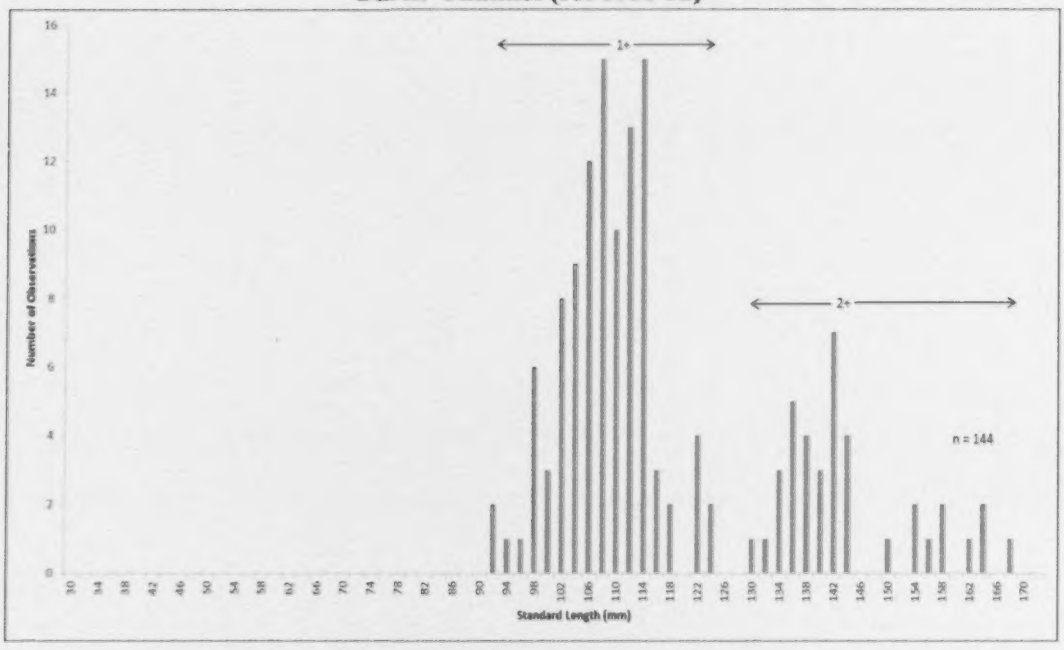


Figure 7…continued

Burke Channel (set code 12)



Dean Channel (set code 13)

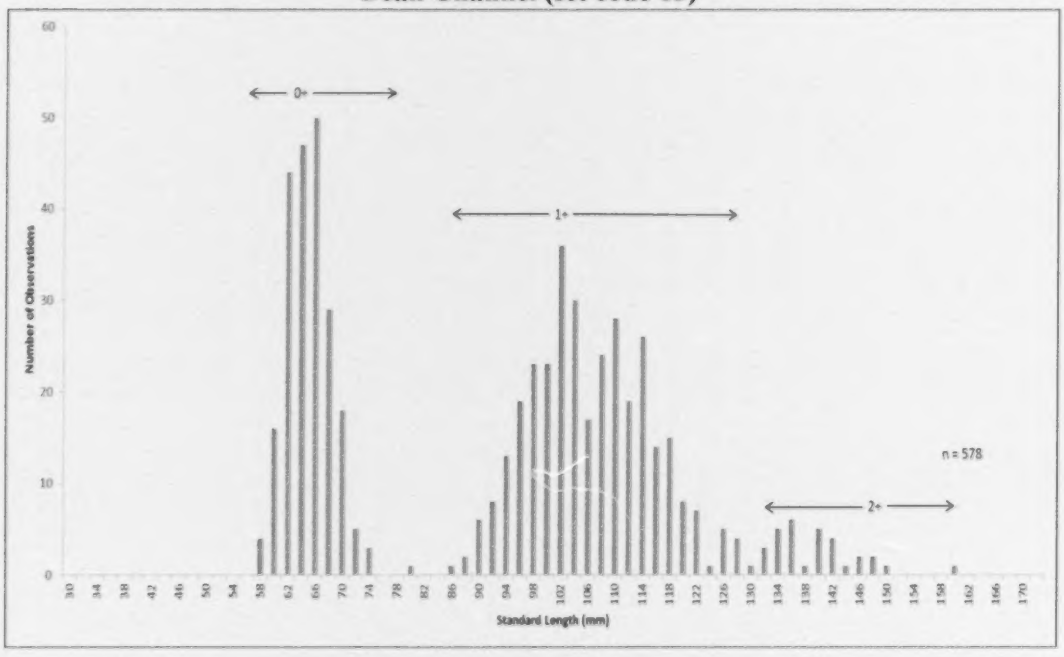


Figure 7…continued

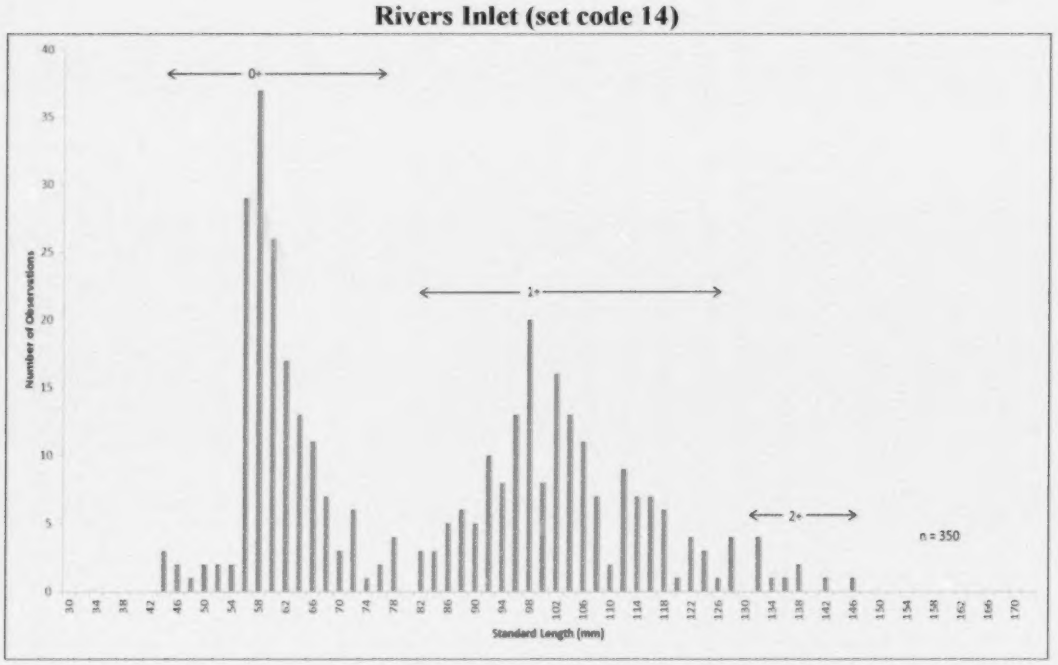


Figure 7…continued

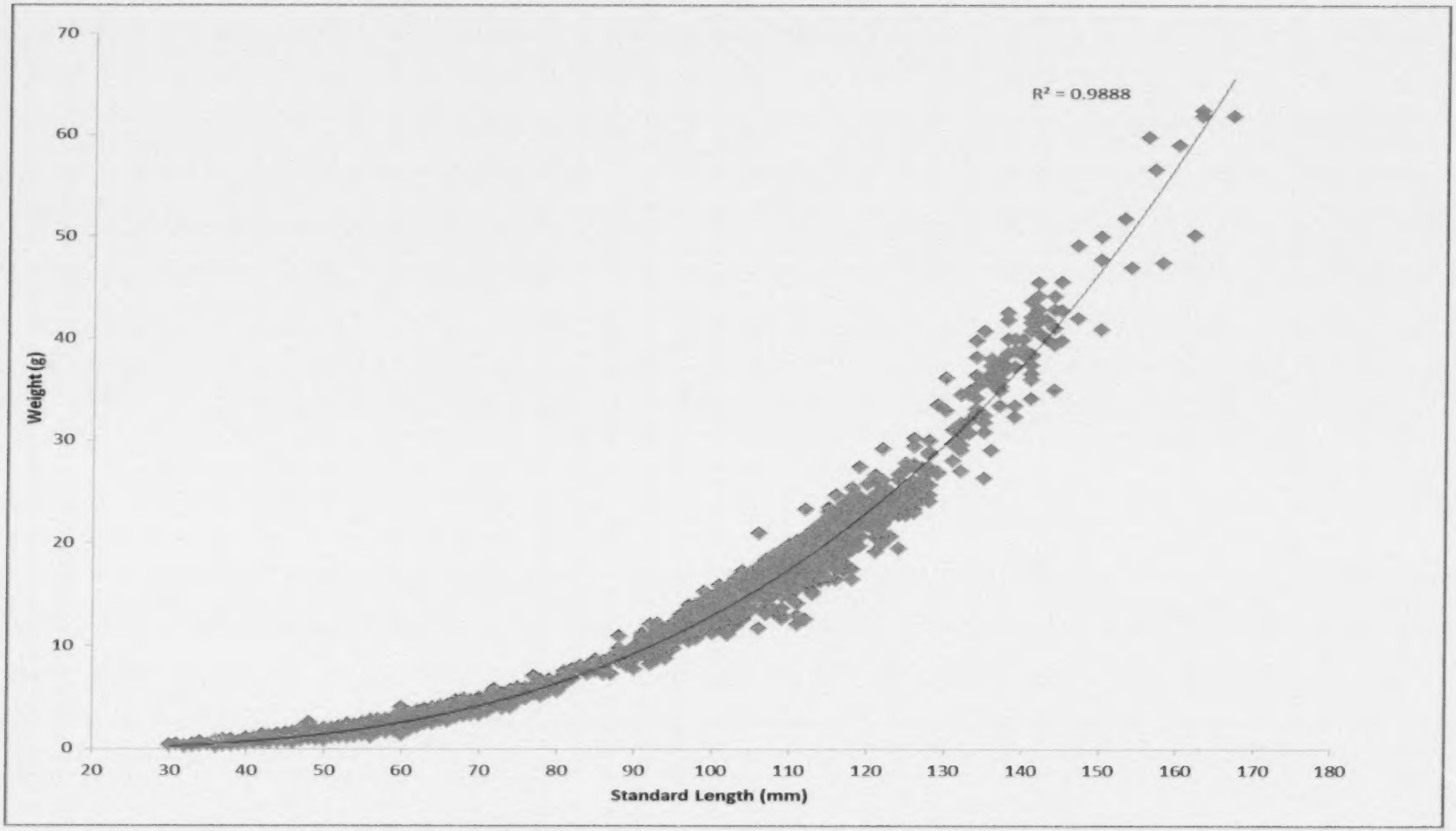


Figure 8. Length-weight relationship for all sampled herring from the 2011 Central Coast juvenile herring survey.

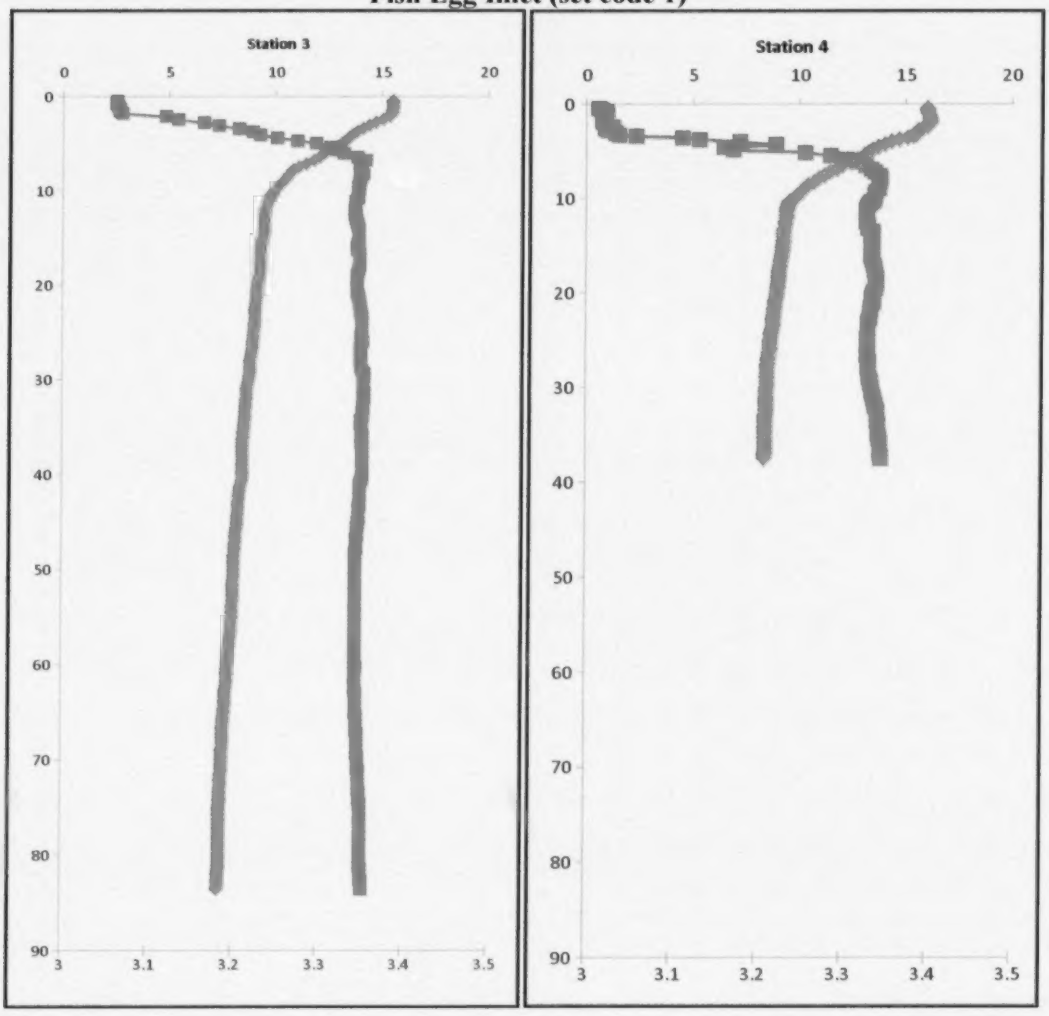


Figure 9. Temperature and salinity profiles from CTD casts during the 2011 Central Coast juvenile herring survey. Blue data points and the top x-axis represent temperature (^{o}C) and red data points and the bottom x-axis represent salinity (‰). Depth in (m) is shown on the y-axis.

Kwakshua Channel (set code 2)

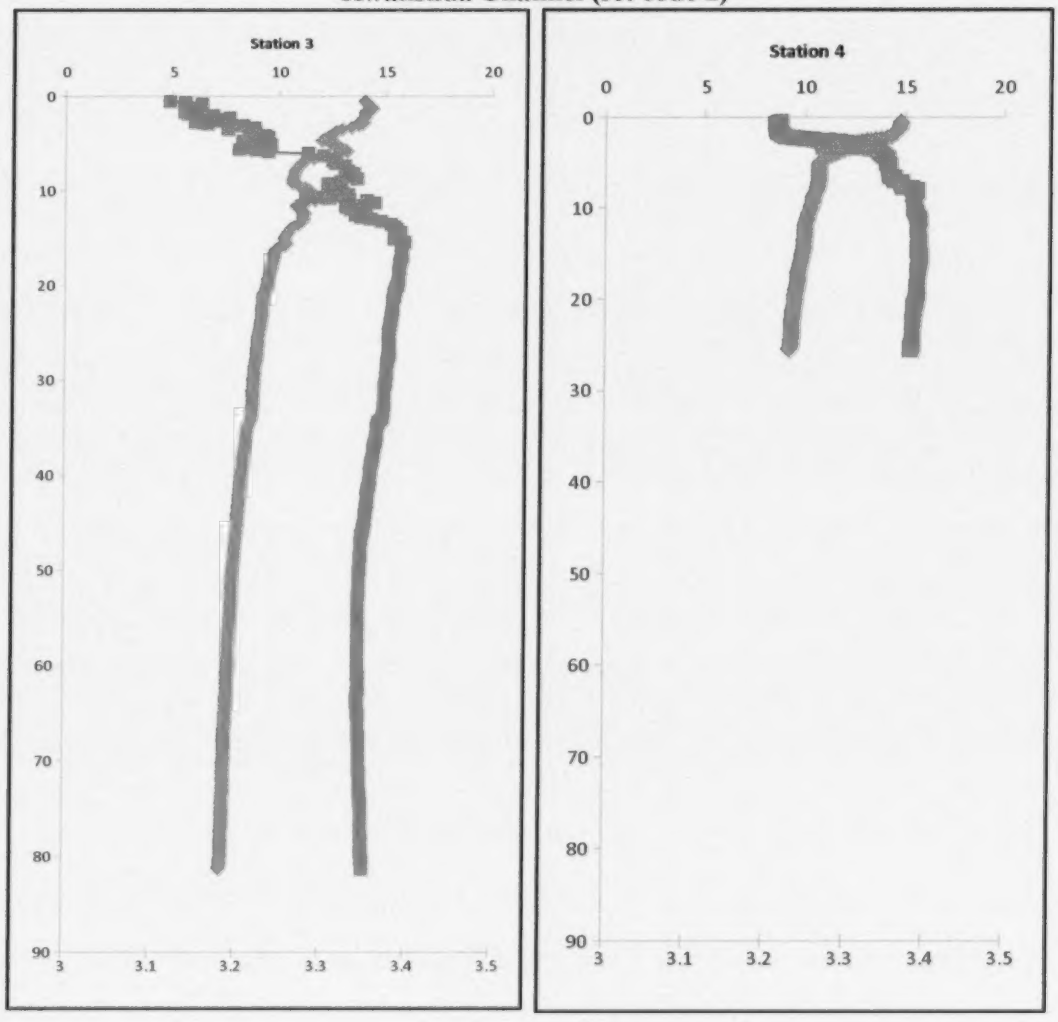


Figure 9 continued…

Kildidt Sound (set code 4)

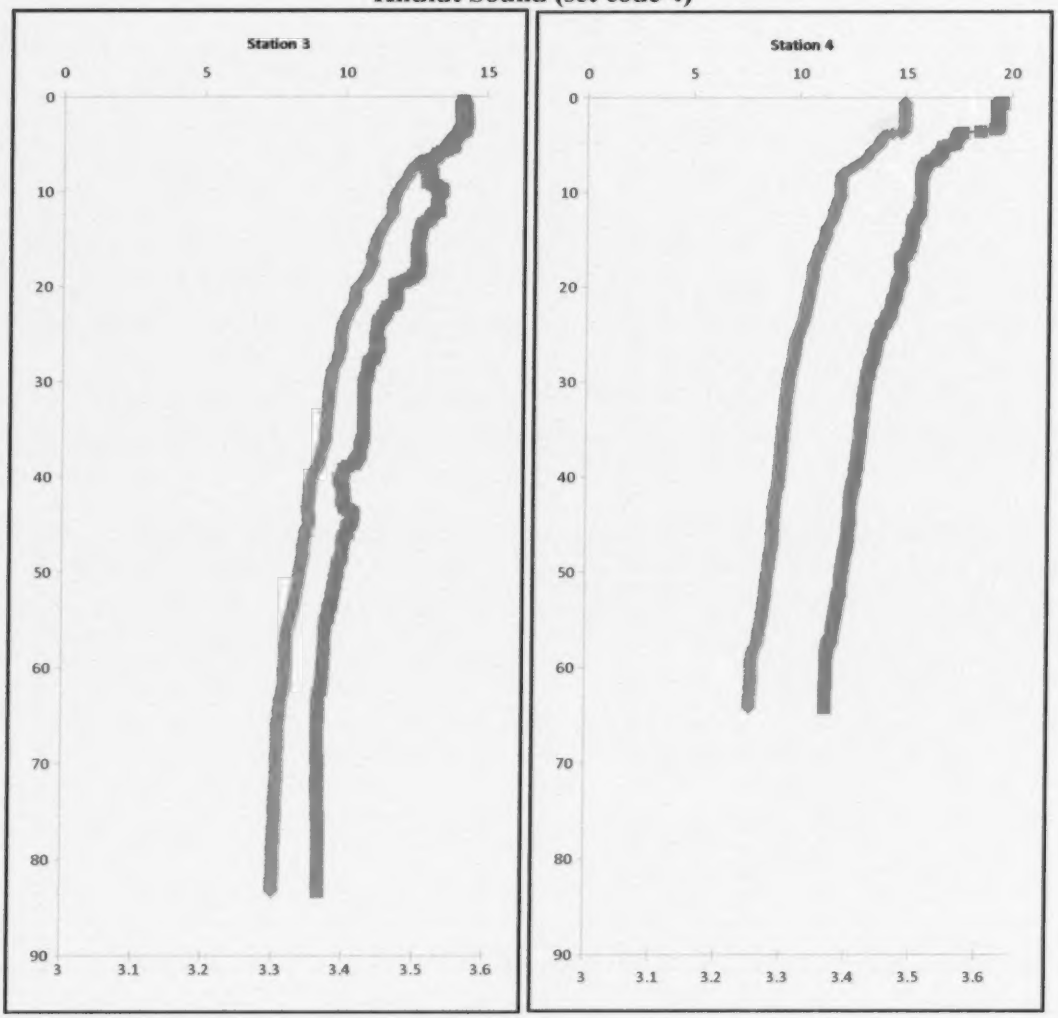


Figure 9 continued. Note change in bottom x-axis scale.

Thompson Bay (set code 5)

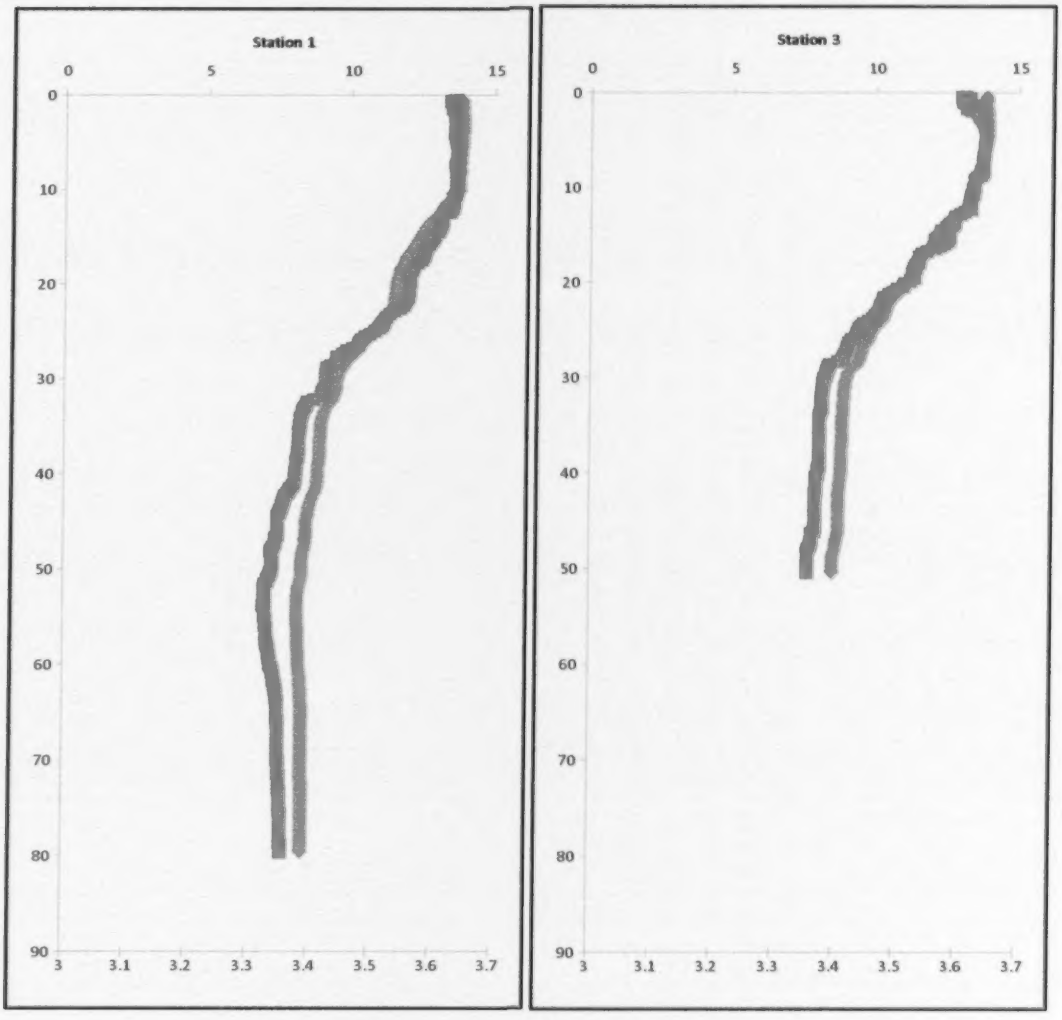


Figure 9 continued. Note change in bottom x-axis scale.

Meyers Passage (set code 6)

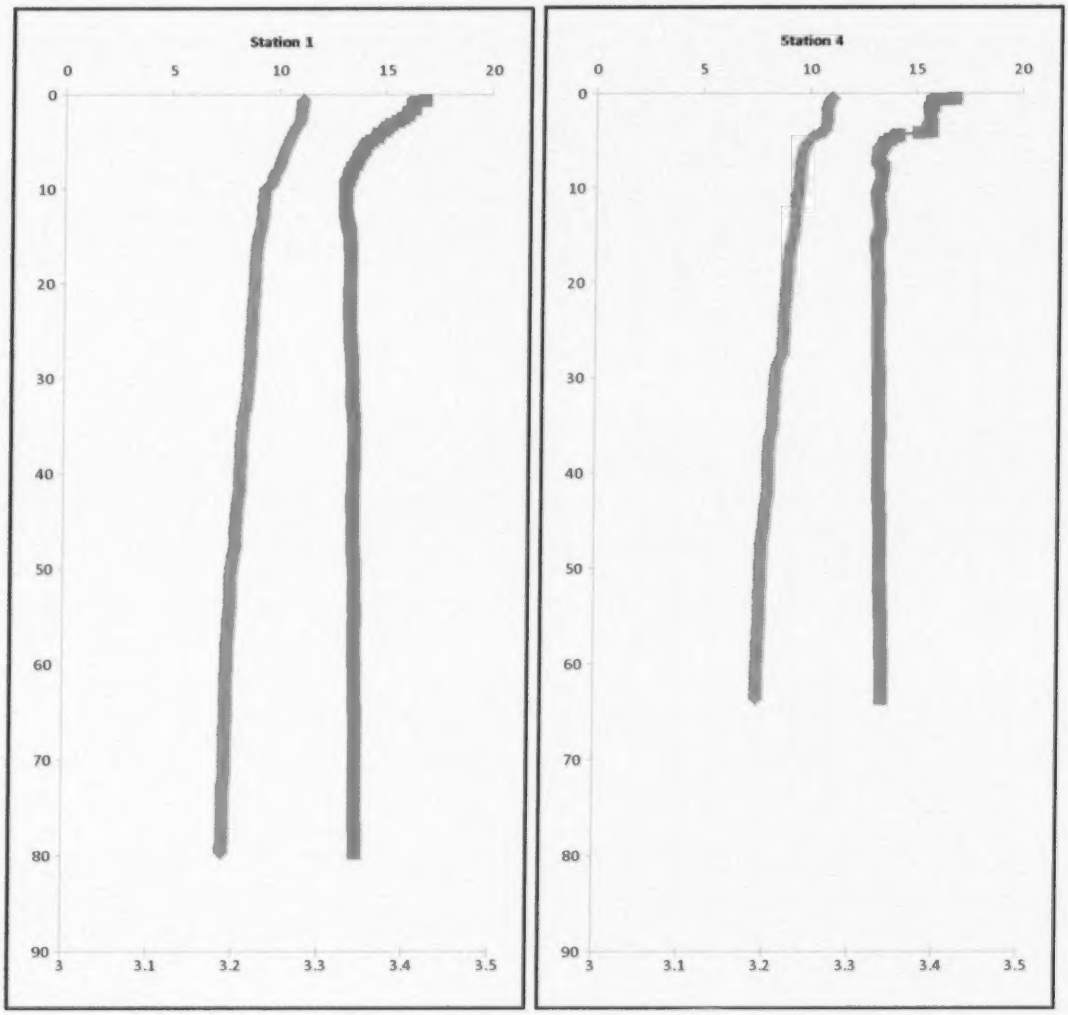


Figure 9 continued…

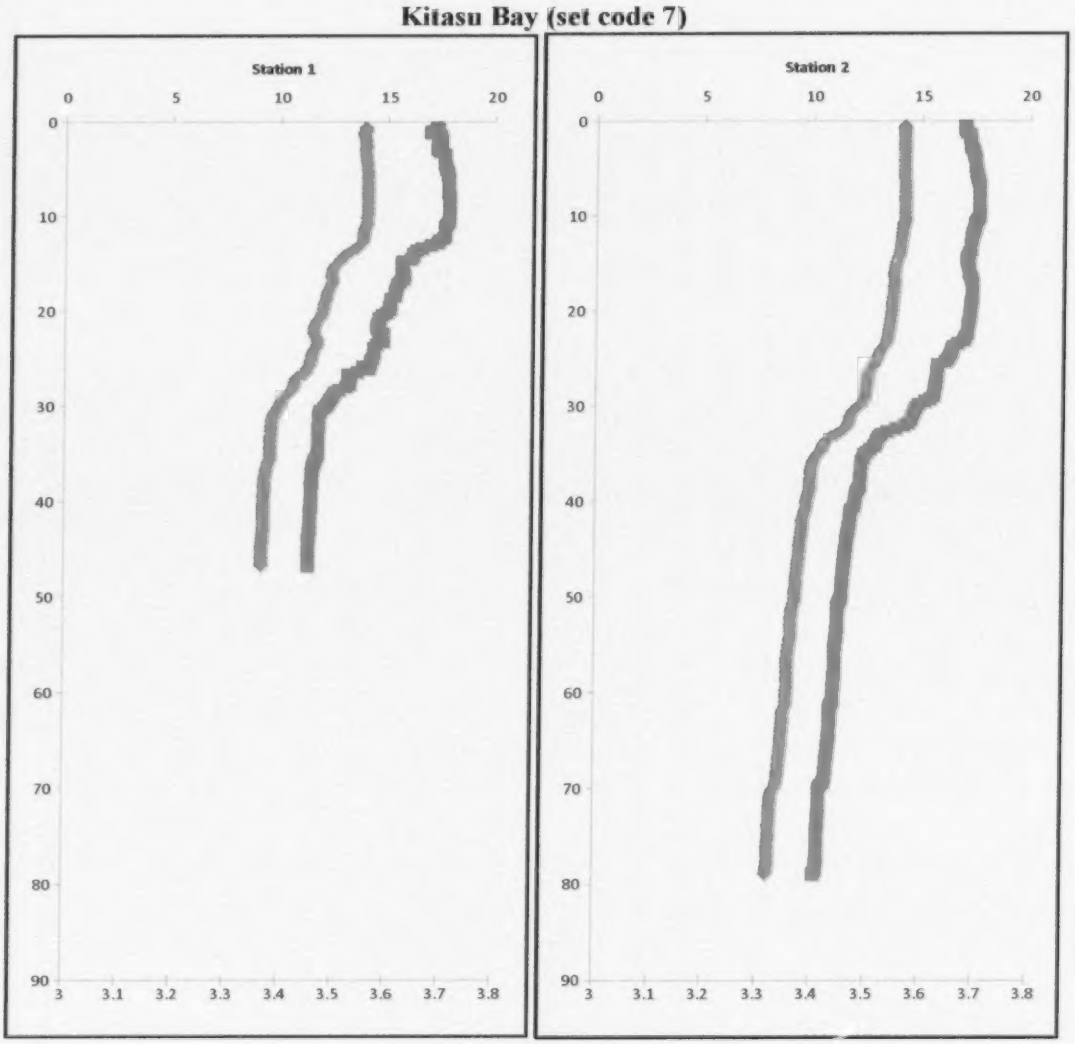


Figure 9 continued. Note change in bottom x-axis scale.

East Higgins Pass (set code 8)

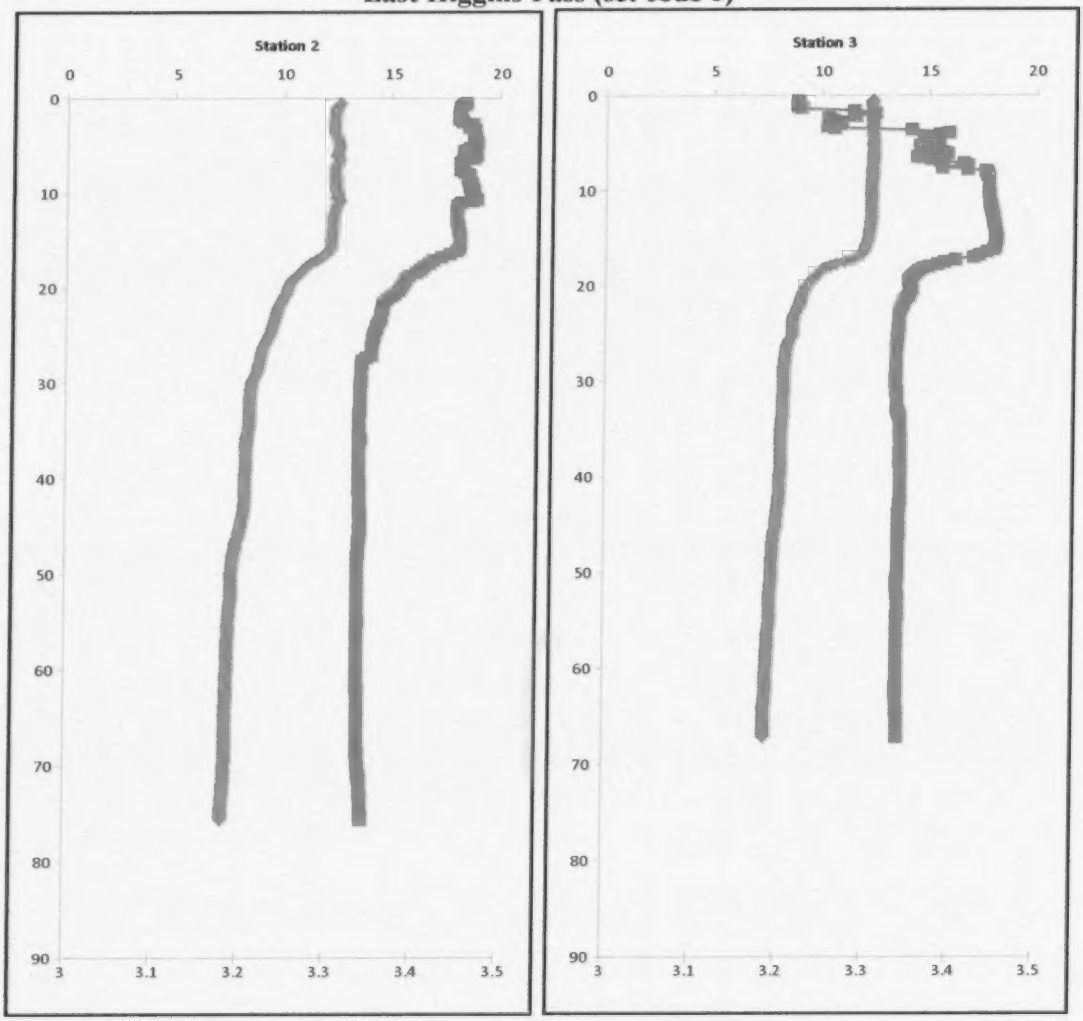


Figure 9 continued…

Powell Anchorage (set code 9)

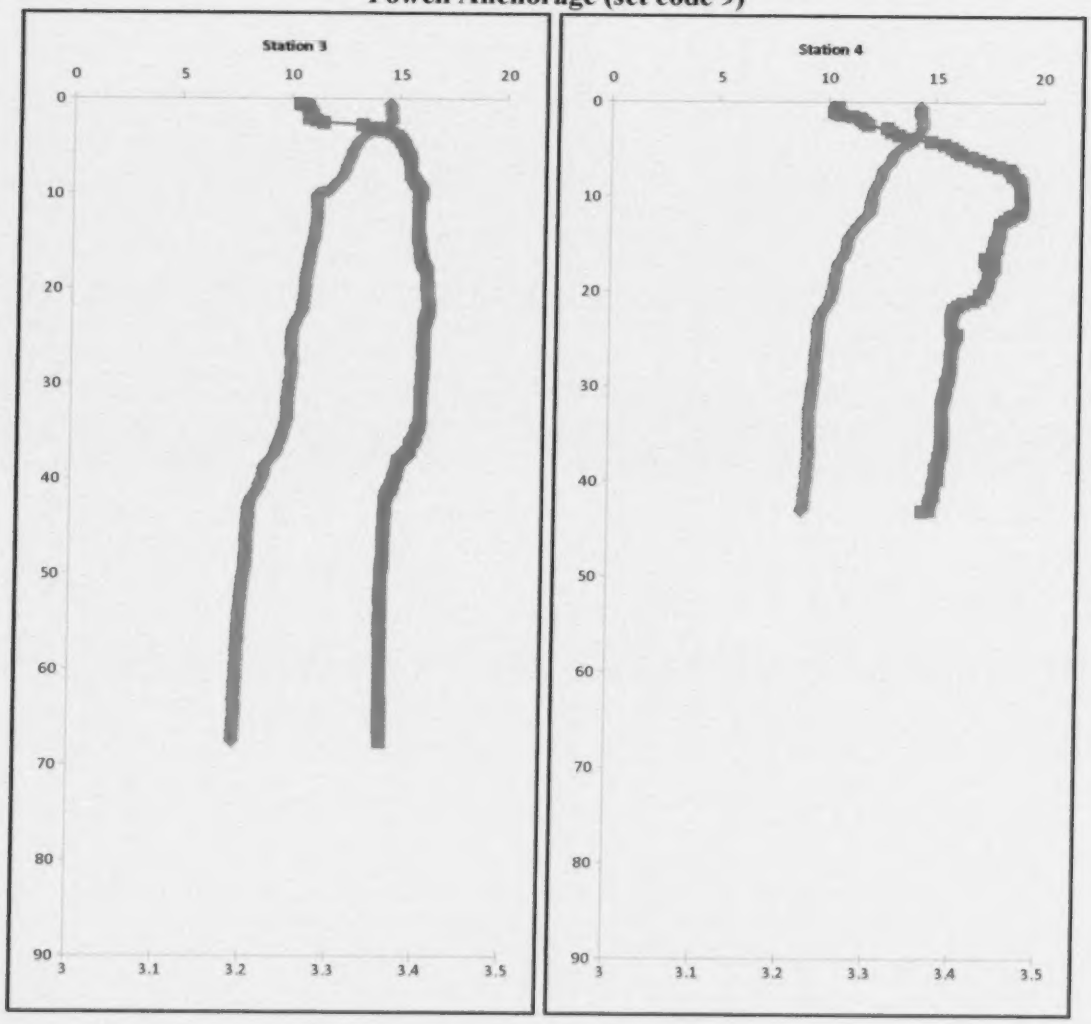


Figure 9 continued…

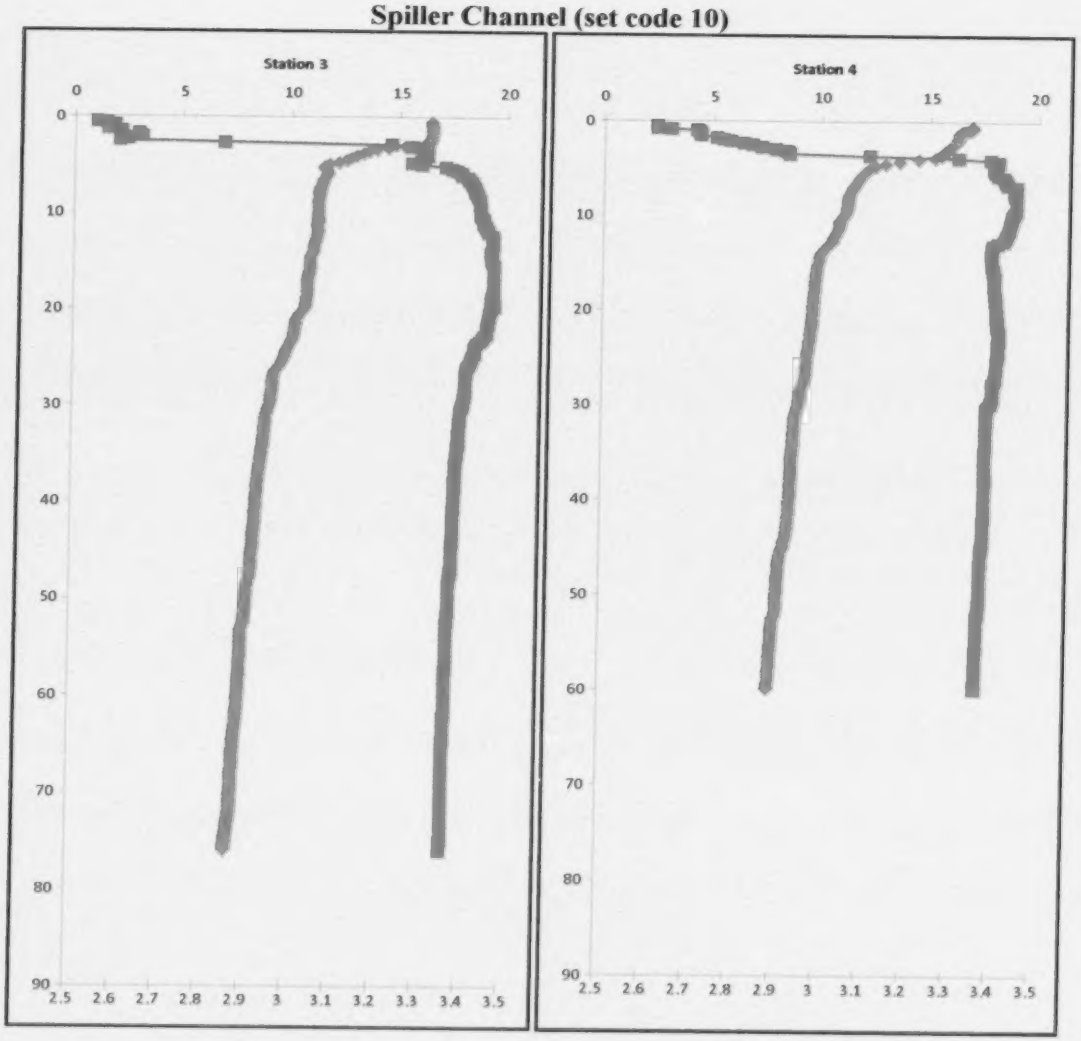


Figure 9 continued. Note change in bottom x-axis scale.

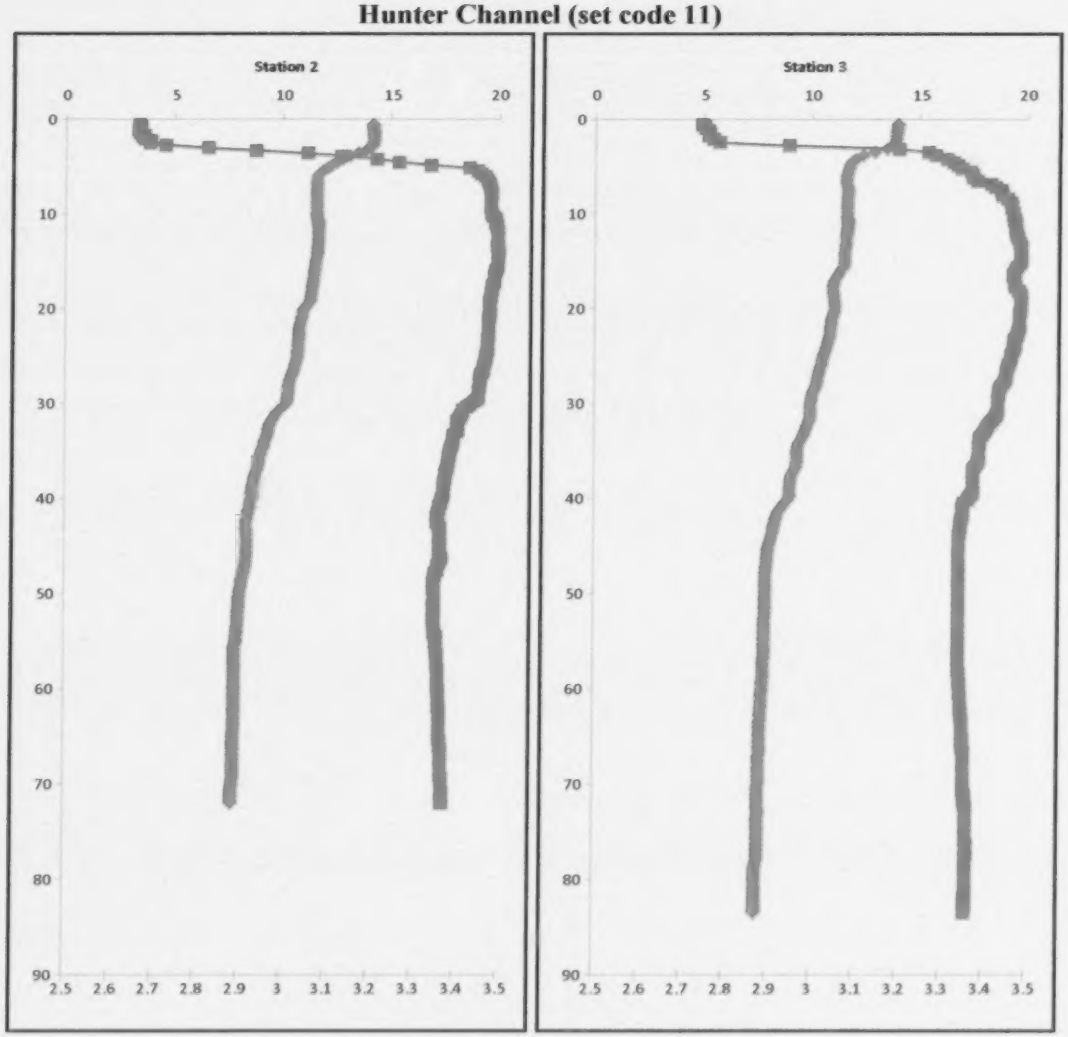


Figure 9 continued. Note change in bottom x-axis scale.

Burke Channel (set code 12)

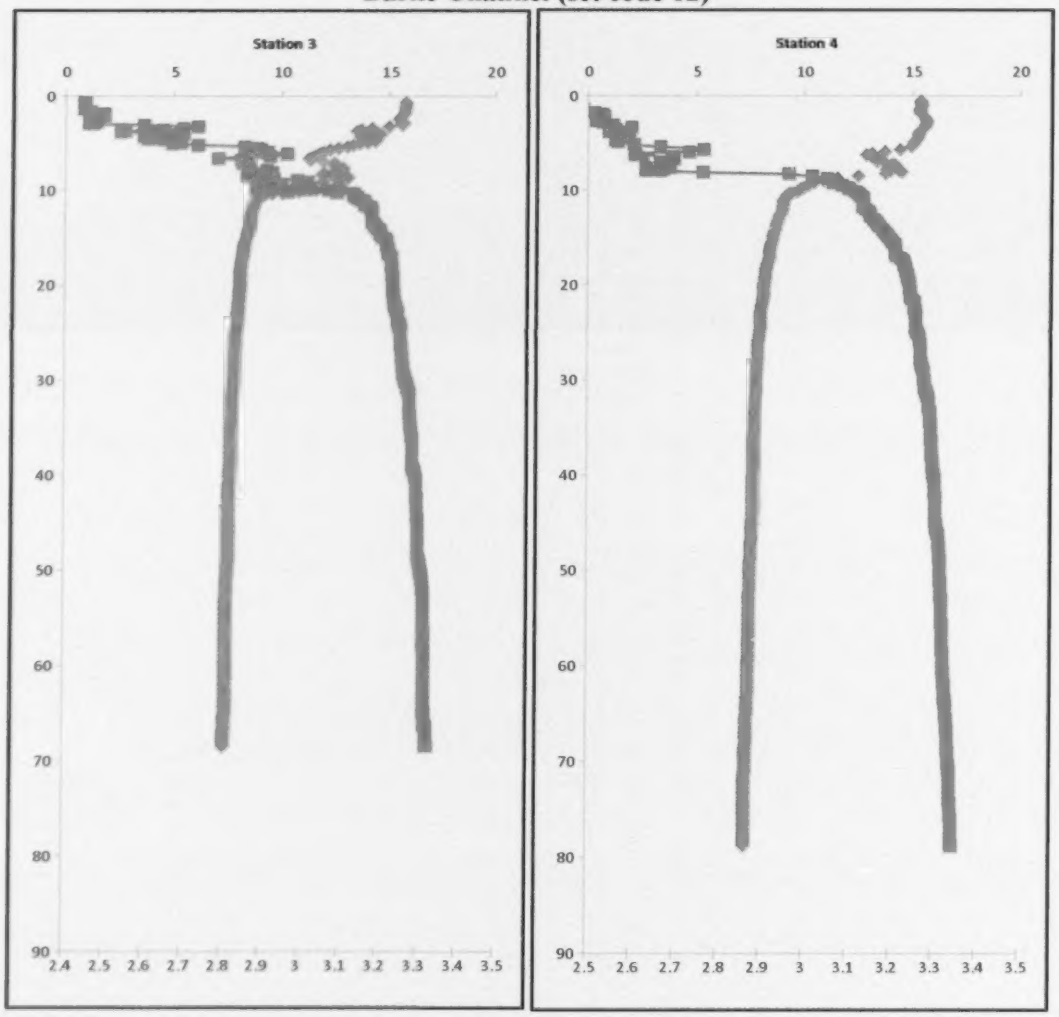


Figure 9 continued. Note change in bottom x-axis scale.

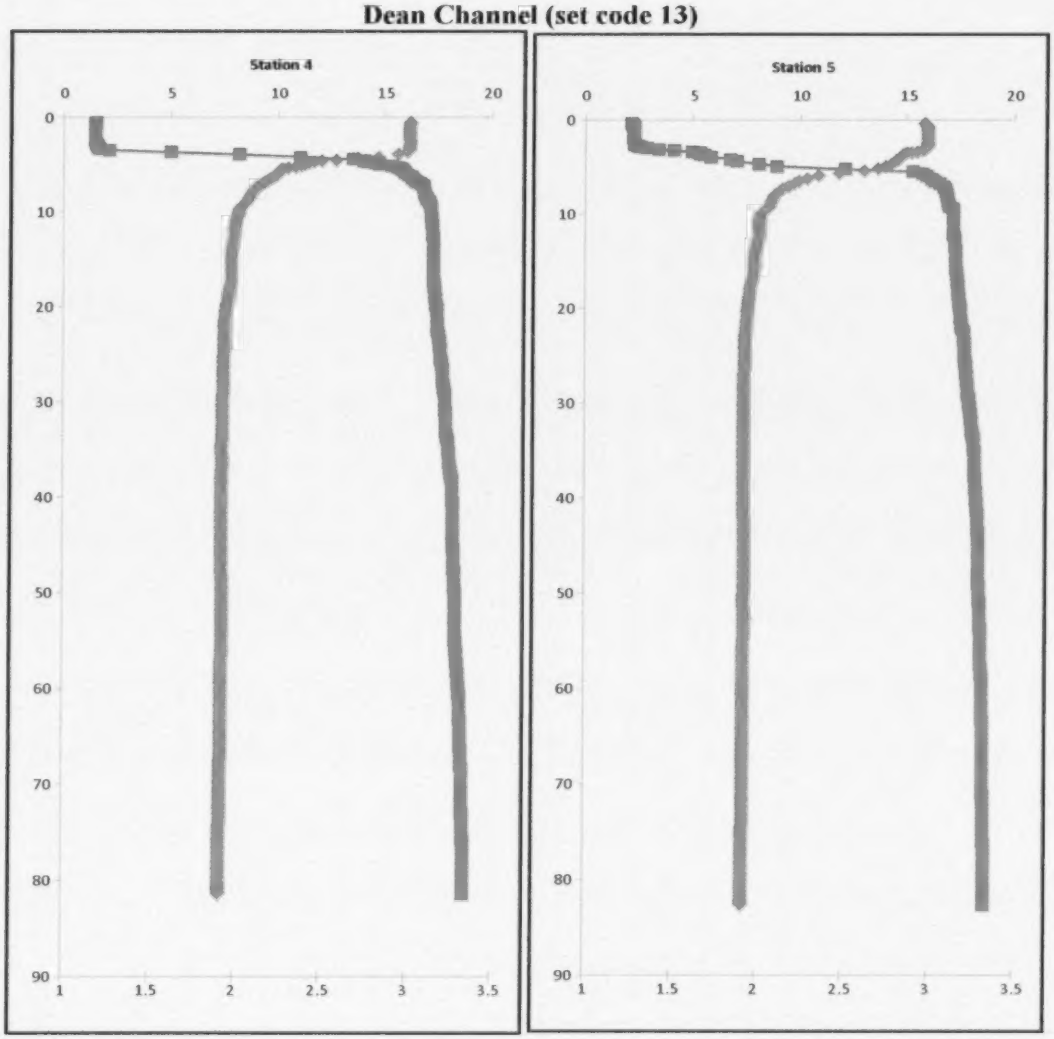


Figure 9 continued. Note change in bottom x-axis scale.

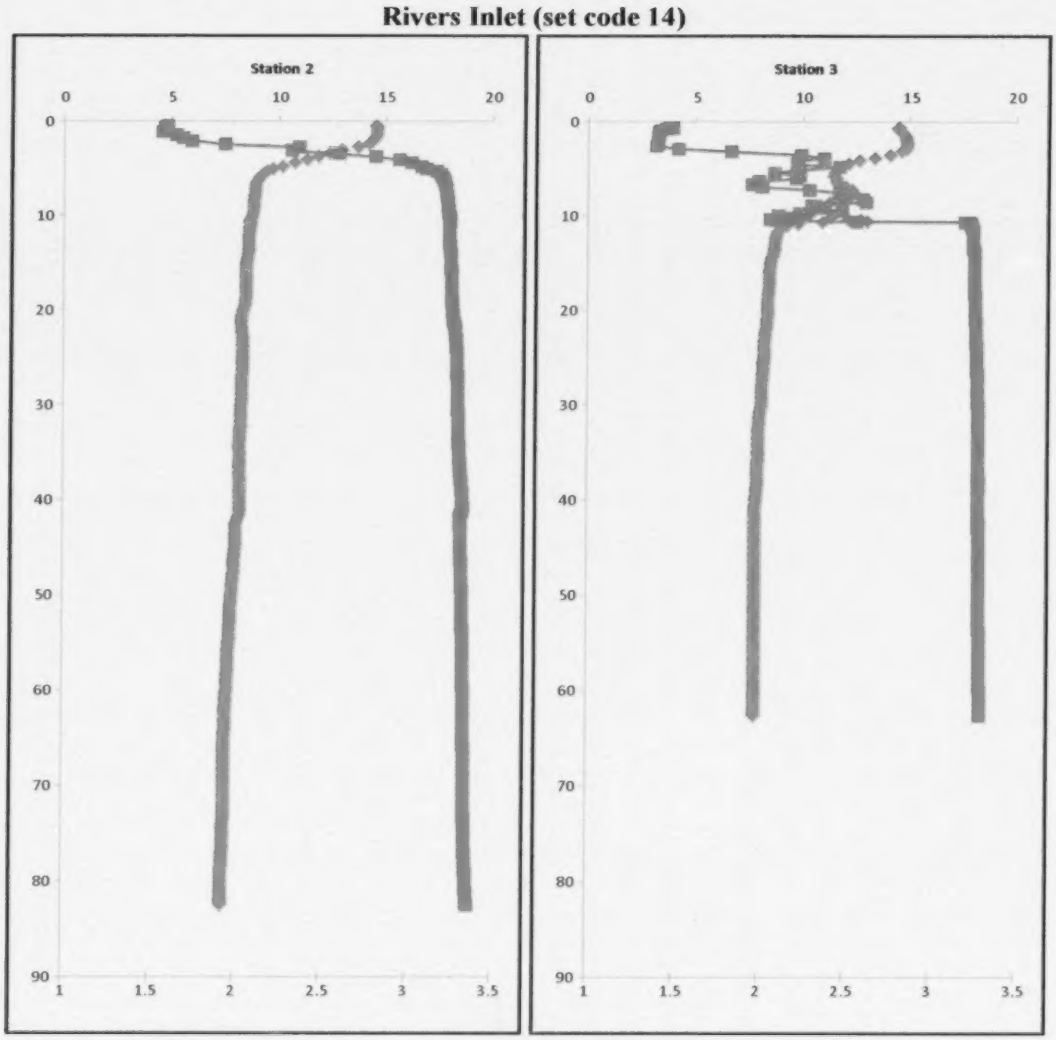


Figure 9 continued. Note change in bottom x-axis scale.

Table 1. Summary of the purse seine set locations from the 2011 Central Coast juvenile herring survey.

Set	Year	Month	Set Day	Set Location Name	Set Code	Station	Set Start Time	DD Lat (N)	DD Long (W)
1	2011	8	8	Kwakshua Channel	2	3	2210	51.648	128.091
2	2011	8	8	Kwakshua Channel	2	4	2235	51.655	128.115
3	2011	8	8	Kwakshua Channel	2	2	2305	51.655	128.053
4	2011	8	8	Kwakshua Channel	2	1	2345	51.676	128.088
5	2011	8	8	Kwakshua Channel	2	5	0010	51.691	128.077
6	2011	8	9	Kildidt Sound	4	3	2215	51.837	128.154
7	2011	8	9	Kildidt Sound	4	4	2240	51.850	128.116
8	2011	8	9	Kildidt Sound	4	1	2310	51.862	128.146
9	2011	8	9	Kildidt Sound	4	5	2340	51.873	128.132
10	2011	8	9	Kildidt Sound	4	2	2410	51.879	128.159
11	2011	8	10	Burke Channel	12	4	2215	52.172	127.573
12	2011	8	10	Burke Channel	12	2	2330	52.124	127.438
13	2011	8	10	Burke Channel	12	5	0005	52.105	127.403
14	2011	8	11	Dean Channel	13	5	2205	52.330	127.535
15	2011	8	11	Dean Channel	13	4	2230	52.314	127.540
16	2011	8	11	Dean Channel	13	3	2255	52.300	127.553
17	2011	8	11	Dean Channel	13	2	2320	52.306	127.582
18	2011	8	11	Dean Channel	13	1	2345	52.318	127.597
19	2011	8	12	Spiller Channel	10	3	2205	52.277	128.235
20	2011	8	12	Spiller Channel	10	4	2235	52.290	128.259
21	2011	8	12	Spiller Channel	10	2	2305	52.268	128.271
22	2011	8	12	Spiller Channel	10	1	2330	52.250	128.274
23	2011	8	12	Spiller Channel	10	5	0015	52.263	128.336
24	2011	8	13	Thompson Bay	5	1	2150	52.121	128.407
25	2011	8	13	Thompson Bay	5	2	2215	52.134	128.378
26	2011	8	13	Thompson Bay	5	3	2240	52.148	128.398
27	2011	8	13	Thompson Bay	5	5	2300	52.159	128.390
28	2011	8	13	Thompson Bay	5	4	2335	52.159	128.354
29	2011	8	14	East Higgins Pass	8	3	2220	52.471	128.638
30	2011	8	14	East Higgins Pass	8	5	2250	52.492	128.661
31	2011	8	14	East Higgins Pass	8	4	2315	52.492	128.693
32	2011	8	15	Kitasu Bay	7	1	2205	52.550	128.800
33	2011	8	15	Kitasu Bay	7	2	2230	52.545	128.771
34	2011	8	15	Kitasu Bay	7	5	2255	52.555	128.751
35	2011	8	15	Kitasu Bay	7	3	2320	52.541	128.742
36	2011	8	15	Kitasu Bay	7	4	2345	52.525	128.751
37	2011	8	16	Meyers Passage	6	4	2155	52.655	128.576
38	2011	8	16	Meyers Passage	6	3	2215	52.665	128.562
39	2011	8	16	Meyers Passage	6	1	2235	52.673	128.572
40	2011	8	16	Meyers Passage	6	2	2300	52.684	128.577

Table 1…continued

Set	Year	Month	Set Day	Set Location Name	Set Code	Station	Set Start Time	DD Lat (N)	DD Long (W)
41	2011	8	16	Meyers Passage	6	5	2330	52.673	128.599
42	2011	8	17	Powell Anchorage	9	3	2205	52.321	128.378
43	2011	8	17	Powell Anchorage	9	4	2230	52.326	128.344
44	2011	8	17	Powell Anchorage	9	5	2255	52.312	128.359
45	2011	8	17	Powell Anchorage	9	1	2325	52.291	128.376
46	2011	8	17	Powell Anchorage	9	2	2350	52.284	128.355
47	2011	8	18	Hunter Channel	11	2	2155	52.057	128.141
48	2011	8	18	Hunter Channel	11	5	2215	52.066	128.159
49	2011	8	18	Hunter Channel	11	4	2245	52.078	128.153
50	2011	8	18	Hunter Channel	11	3	2305	52.073	128.135
51	2011	8	18	Hunter Channel	11	1	2335	52.057	128.115
52	2011	8	19	Fish Egg Inlet	1	4	2120	51.647	127.828
53	2011	8	19	Fish Egg Inlet	1	3	2145	51.617	127.832
54	2011	8	19	Fish Egg Inlet	1	5	2220	51.632	127.777
55	2011	8	19	Fish Egg Inlet	1	2	2250	51.604	127.773
56	2011	8	19	Rivers Inlet	14	3	220	51.592	127.568
57	2011	8	19	Rivers Inlet	14	5	255	51.565	127.589
58	2011	8	19	Rivers Inlet	14	4	315	51.572	127.575

Table 2. Summary of the number and weight by species, transect, and station from the 2011 Central Coast juvenile herring survey.

Set	Set Code	Station	Set Location Name	Species	Number	Weight (kg)*
1	2	3	Kwakshua Channel	**Pacific herring age-0+**	1275	2.04
				Pacific herring age-1+	5	0.07
				Pacific sardine	275	57.45
2	2	4	Kwakshua Channel	**Pacific herring age-0+**	9	0.02
				Pacific herring age-1+	12	0.22
				Pacific herring age-2+	2	0.08
				Chum salmon	6	0.25
				Pacific sand lance	2	trace
3	2	2	Kwakshua Channel	**Pacific herring age-0+**	16	0.02
				Pacific herring age-1+	158	2.54
				Squid	8	0.14
				Chum salmon	6	0.22
				Juvenile hake	4	trace
				Capelin	2	0.02
				Pink salmon	2	0.06
				Pacific sand lance	2	trace
4	2	1	Kwakshua Channel	**Pacific herring age-1+**	19	0.37
				Chum salmon	6	0.20
				Pink salmon	1	0.02
				Pacific sand lance	1	trace
5	2	5	Kwakshua Channel	**Pacific herring age-0+**	1	trace
				Pacific herring age-1+	19	0.35
				Chum salmon	27	0.85
				Pink salmon	2	0.03
				Juvenile rockfish	1	trace
6	4	3	Kildidt Sound	**Pacific herring age-0+**	115	0.11
				Pacific herring age-1+	14	0.21
				Pacific herring age-2+	1	0.04
				Capelin	1210	0.80
				Sculpin	4	trace
				Three-spine stickleback	4	trace
				Pink salmon	1	0.03

* Weights < 0.10g referred to as trace

Table 2 continued...

Set	Set Code	Station	Set Location Name	Species	Number	Weight (kg)*
7	4	4	Kildidt Sound	**Pacific herring age-0+**	406	0.40
				Pacific herring age-1+	1	0.01
				Capelin	12	trace
				Shrimp	4	0.01
				Juvenile hake	2	trace
				Juvenile rockfish	2	trace
				Sculpin	1	trace
8	4	1	Kildidt Sound	**Pacific herring age-0+**	484	0.37
				Pacific herring age-1+	10	0.13
				Shrimp	92	0.21
				Juvenile hake	20	0.25
9	4	5	Kildidt Sound	**Pacific herring age-0+**	21	0.02
				Pacific herring age-1+	1	0.01
				Squid	37	0.56
				Pink salmon	1	2.00
10	4	2	Kildidt Sound	**Pacific herring age-0+**	5	0.02
				Pacific herring age-1+	2	0.02
				Juvenile rockfish	1	trace
11	12	4	Burke Channel	**Pacific herring age-2+**	29	1.24
				Pacific herring age-1+	5	0.13
				Northern smoothtongue	5	0.03
				Capelin	4	0.01
				Coho salmon	1	0.01
				Juvenile walleye pollock	1	trace
12	12	2	Burke Channel	**Pacific herring age-1+**	4	0.06
				Pacific herring age-2+	6	0.24
				Capelin	59	0.05
				Three-spine stickleback	11	0.02
				Coho salmon	1	trace

Table 2 continued...

Set	Set Code	Station	Set Location Name	Species	Number	Weight (kg)*
13	12	5	Burke Channel	**Pacific herring age-1+**	573	9.68
				Pacific herring age-2+	6	0.21
				Spiny dogfish	50	50.00
				Capelin	12	0.04
				Three-spine stickleback	6	0.02
				Chum salmon	1	3.00
14	13	5	Dean Channel	**Pacific herring age-1+**	12	0.04
				Pacific herring age-2+	248	3.74
				Pacific herring age-0+	28	1.07
				Three-spine stickleback	2	trace
15	13	4	Dean Channel	**Pacific herring age-0+**	8	0.03
				Pacific herring age-1+	67	1.05
				Pacific herring age-2+	3	0.91
				Three-spine stickleback	115	0.41
				Chinook salmon	4	0.08
				Coho salmon	2	0.04
16	13	3	Dean Channel	**Pacific herring age-0+**	224	0.73
				Pacific herring age-1+	87	1.36
				Pacific herring age-2+	6	0.27
				Capelin	889	0.50
				Three-spine stickleback	7	0.02
				Chinook salmon	1	0.02
17	13	2	Dean Channel	**Pacific herring age-0+**	3	0.01
				Pacific herring age-1+	28	0.47
				Pacific herring age-2+	2	0.07
				Three-spine stickleback	12	0.04
				Capelin	10	trace
18	13	1	Dean Channel	**Pacific herring age-0+**	966	3.01
				Pacific herring age-1+	186	3.05
				Pacific herring age-2+	18	0.63
				Three-spine stickleback	3	0.02

Table 2 continued...

Set	Set Code	Station	Set Location Name	Species	Number	Weight (kg)*
19	10	3	Spiller Channel	**Pacific herring age-0+**	5819	21.02
				Pacific herring age-1+	55	0.80
				Capelin	11	0.01
20	10	4	Spiller Channel	**Pacific herring age-0+**	713	1.15
				Pacific herring age-1+	17	0.23
				Coho salmon	2	2.50
				Tubesnout	2	trace
21	10	2	Spiller Channel	**Pacific herring age-0+**	684	1.60
				Pacific herring age-1+	220	3.61
				Capelin	20	0.02
22	10	1	Spiller Channel	**Pacific herring age-0+**	61	0.22
				Pacific herring age-1+	54	1.02
				Pacific herring age-2+	3	0.13
				Chinook salmon	2	0.18
23	10	5	Spiller Channel	**Pacific herring age-1+**	375	7.72
				Pacific herring age-0+	132	0.52
				Pacific herring age-2+	33	1.19
				Shiner perch	3	0.08
24	5	1	Thompson Bay	**Pacific herring age-0+**	678	2.12
				Capelin	4	0.02
25	5	2	Thompson Bay	**Pacific herring age-0+**	160	0.66
				Pacific herring age-1+	38	0.62
				Pacific herring age-2+	2	0.08
				Capelin	20	0.19
				Eulachon	2	0.03
				Spiny dogfish	1	0.20
26	5	3	Thompson Bay	**Pacific herring age-0+**	60	0.13
				Capelin	2	0.02

Table 2 continued...

Set	Set Code	Station	Set Location Name	Species	Number	Weight (kg)*
27	5	5	Thompson Bay	**Pacific herring age-0+**	3	trace
				Squid	10	0.21
				Juvenile walleye pollock	1	trace
				Shiner perch	1	0.03
28	5	4	Thompson Bay	**Pacific herring age-0+**	105	0.20
				Juvenile hake	4	trace
				Juvenile rockfish	3	trace
				Squid	1	0.02
29	8	3	East Higgins Pass	***No Catch***		
30	8	5	East Higgins Pass	**Pacific herring age-0+**	4	trace
				Juvenile hake	1	trace
31	8	4	East Higgins Pass	**Pacific herring age-0+**	6	trace
				Pacific herring age-1+	8	0.14
				Juvenile rockfish	9	0.01
				Capelin	4	trace
				Juvenile walleye pollock	1	trace
32	7	1	Kitasu Bay	**Pacific herring age-0+**	15	0.03
				Pacific herring age-1+	33	0.60
				Pink salmon	16	0.45
				Chinook salmon	2	0.31
				Juvenile hake	1	trace
33	7	2	Kitasu Bay	**Pacific herring age-0+**	4	0.02
				Pacific herring age-1+	44	0.62
				Chinook salmon	1	0.12
34	7	5	Kitasu Bay	**Pacific herring age-0+**	59	0.17
				Pacific herring age-1+	17	0.21
35	7	3	Kitasu Bay	**Pacific herring age-0+**	16	0.05
				Pacific herring age-1+	1	trace
				Capelin	1	trace

Table 2 continued...

Set	Set Code	Station	Set Location Name	Species	Number	Weight (kg)*
36	7	4	Kitasu Bay	**Pacific herring age-0+**	516	1.88
				Pacific herring age-1+	1	trace
37	6	4	Meyers Passage	**Pacific herring age-0+**	21	0.04
				Pacific herring age-1+	1	0.01
				Capelin	1	trace
38	6	3	Meyers Passage	**Pacific herring age-0+**	7	0.02
				Pacific herring age-1+	1	0.02
				Squid	1	0.03
39	6	1	Meyers Passage	**Pacific herring age-0+**	3	trace
				Pacific herring age-1+	2	0.03
40	6	2	Meyers Passage	**Pacific herring age-0+**	5	0.02
				Pacific herring age-1+	3	0.04
				Three-spine stickleback	8	0.01
				Pink salmon	1	0.02
41	6	5	Meyers Passage	**Pacific herring age-0+**	8	0.03
				Pacific herring age-1+	1	trace
				Three-spine stickleback	6	0.02
				Capelin	1	trace
42	9	3	Powell Anchorage	**Pacific herring age-0+**	3	0.01
				Pacific herring age-1+	5	0.09
43	9	4	Powell Anchorage	**Pacific herring age-0+**	3702	5.87
				Capelin	24	0.19
44	9	5	Powell Anchorage	**Pacific herring age-0+**	457	0.64
				Pacific herring age-1+	1	0.02
				Three-spine stickleback	1	trace
45	9	1	Powell Anchorage	**Pacific herring age-0+**	10897	14.31
				Pacific sand lance	17	0.02

Table 2 continued...

Set	Set Code	Station	Set Location Name	Species	Number	Weight (kg)*
46	9	2	Powell Anchorage	**Pacific herring age-0+**	5434	7.20
				Pacific herring age-1+	55	0.50
				Juvenile walleye pollock	11	0.82
47	11	2	Hunter Channel	**Pacific herring age-1+**	2	0.03
48	11	5	Hunter Channel	**Pacific herring age-0+**	7	0.03
				Pacific herring age-1+	15	0.24
				Pacific herring age-2+	1	0.03
				Chum salmon	1	0.13
				Squid	1	trace
49	11	4	Hunter Channel	**Pacific herring age-0+**	2	trace
				Pacific herring age-1+	13	0.24
				Pacific herring age-2+	1	0.04
				Squid	1	trace
50	11	3	Hunter Channel	**Pacific herring age-0+**	1	trace
				Pacific herring age-1+	13	0.24
				Pacific herring age-2+	1	0.03
				Pink salmon	2	4.00
				Coho salmon	1	3.50
51	11	1	Hunter Channel	**Pacific herring age-0+**	4998	10.39
52	1	4	Fish Egg Inlet	**Pacific herring age-0+**	30331	40.88
				Capelin	147	0.16
53	1	3	Fish Egg Inlet	**Pacific herring age-0+**	16071	30.54
				Capelin	33	0.02
54	1	5	Fish Egg Inlet	**Pacific herring age-0+**	5949	9.26
				Pacific herring age-1+	36	0.47
				Three-spine stickleback	639	0.50
				Capelin	9	trace
				Pile perch	9	0.01

Table 2 continued...

Set	Set Code	Station	Set Location Name	Species	Number	Weight (kg)*
55	1	2	Fish Egg Inlet	**Pacific herring age-0+**	9279	7.27
				Capelin	1314	0.53
56	14	3	Rivers Inlet	**Pacific herring age-0+**	74	0.26
				Pacific herring age-1+	152	2.20
				Pacific herring age-2+	6	0.23
				Three-spine stickleback	6	0.01
				Chinook salmon	2	0.06
57	14	5	Rivers Inlet	**Pacific herring age-0+**	2286	5.70
				Pacific herring age-1+	1593	24.63
				Pacific herring age-2+	63	2.02
				Capelin	144	0.10
				Northern anchovy	9	0.22
				Chinook salmon	9	0.15
				Three-spine stickleback	9	trace
58	14	4	Rivers Inlet	**Pacific herring age-0+**	750	2.12
				Pacific herring age-1+	100	1.46
				Capelin	162675	82.19

Table 3. Percent occurrence by species in purse seine sets from the 2011 Central Coast juvenile herring survey.

Species Caught		
Common Name	**Scientific Name**	**% Occurrence**
Pacific herring age-0+	*Clupea pallasi* in year of birth	89.7
Pacific herring age-1+	*Clupea pallasi* in first year	79.3
Pacific herring age-2+	*Clupea pallasi* in second or more years	31.0
Capelin	*Mallotus villosus*	41.4
Chinook salmon	*Oncorhynchus tshawytscha*	12.1
Chum salmon	*Oncorhynchus keta*	10.3
Coho salmon	*Oncorhynchus kisutch*	8.6
Eulachon	*Thaleichthys pacificus*	1.7
Juvenile hake	*Merluccius productus*	10.3
Juvenile pollock	*Theragra chalcogramma*	6.9
Juvenile rockfish	*Sebastes sp.*	8.6
Northern anchovy	*Engraulis mordax mordax*	1.7
Northern smoothtongue	*Leuroglossus stilbius schmidti*	1.7
Pacific sardine	*Sardinops sagax*	1.7
Pile perch	*Rhacochilus vacca*	1.7
Pink salmon	*Oncorhynchus gorbuscha*	13.8
Sand lance	*Ammodytes hexapterus*	6.9
Sculpin	*Leptocottus armatus*	3.4
Shiner perch	*Cymatogaster aggregata*	3.4
Shrimp	*Pandalus sp.*	3.4
Spiny dogfish	*Squalus acanthias*	3.4
Squid	*Loligo opalescens* or *Gonatus fabricii*	12.1
Three-spine stickleback	*Gasterosteus aculeatus*	24.1
Tubesnout	*Aulorhynchus flavidus*	1.7

Table 4. Summary of the number of herring sampled including length and weight (range, mean, and standard deviations) for each of the three herring age classes encountered. Total catch in numbers (N) and weight (Wt) of all herring by transect for the 2011 Central Coast juvenile herring survey.

Age-0+			Length (mm)			Weight (g)				
Location Name	Set Code	Number of Fish Sampled	Range	Mean	SD	Range	Mean	SD	N	Wt (Kg)
Fish Egg Inlet	1	404	38-76	50	6.44	0.45-5.33	1.40	0.63	61630	87.95
Kwakshua	2	118	32-72	55	5.19	0.33-4.07	1.61	0.50	1301	2.08
Kildidt Sound	4	341	30-79	44	5.01	0.24-7.02	0.95	0.59	1031	0.92
Thompson Bay	5	349	46-81	60	6.98	1.23-7.51	2.82	1.14	1006	3.13
Meyers Passage	6	45	41-81	56	9.71	1.00-6.77	2.40	1.30	44	0.10
Kitasu Bay	7	193	40-78	61	5.31	0.81-6.51	3.21	0.88	610	2.15
East Higgins Pass	8	10	34-75	51	11.37	0.48-5.02	1.73	1.31	10	0.02
Powell Anchorage	9	404	31-76	47	4.24	0.45-5.84	1.38	0.41	20493	28.03
Spiller Channel	10	407	39-81	61	8.51	0.53-6.69	2.86	1.27	7409	24.51
Hunter Channel	11	110	52-80	58	5.52	1.62-5.60	2.32	0.74	5008	10.43
Burke Channel	12	-	-	-	-	-	-	-	-	-
Dean Channel	13	217	57-80	65	3.44	2.04-5.77	3.20	0.54	1213	3.82
Rivers Inlet	14	170	44-81	60	6.55	0.86-7.19	2.82	1.03	3110	8.08
TOTALS		2768	30-81	55	9.32	0.24-7.51	2.15	1.19	102864	171.22

Table 4 continued...

Age-1+			Length (mm)			Weight (g)				
Location Name	Set Code	Number of Fish Sampled	Range	Mean	SD	Range	Mean	SD	N	Wt (Kg)
Fish Egg Inlet	1	4	96-106	100	4.19	10.75-16.40	13.10	2.45	36	0.47
Kwakshua Channel	2	130	85-129	110	8.51	7.62-28.65	17.17	3.94	213	3.56
Kildidt Sound	4	23	82-125	103	12.12	7.58-24.51	13.80	4.92	28	0.38
Thompson Bay	5	18	82-126	103	15.02	7.50-25.40	16.76	6.56	38	0.62
Meyers Passage	6	7	88-117	101	12.23	10.63-20.63	14.51	4.22	8	0.11
Kitasu Bay	7	96	85-126	105	8.23	7.29-25.99	15.06	3.58	96	1.45
East Higgins Pass	8	8	101-124	111	7.19	12.71-23.07	17.31	3.48	8	0.14
Powell Anchorage	9	11	83-126	100	14.74	7.46-23.85	14.26	6.21	61	0.61
Spiller Channel	10	276	87-130	110	7.39	8.74-33.49	17.84	4.14	721	13.37
Hunter Channel	11	43	94-128	112	8.05	9.70-28.88	17.55	4.29	43	0.75
Burke Channel	12	107	91-130	108	6.87	8.78-36.11	17.11	3.61	582	9.86
Dean Channel	13	330	86-129	106	8.79	7.29-29.99	15.81	4.17	616	9.62
Rivers Inlet	14	170	82-128	102	10.53	6.79-30.22	14.80	4.81	1845	28.30
TOTALS		1223	82-130	107	9.22	6.79-36.11	16.34	4.37	4295	69.29

Table 4 continued...

Age-2+			Length (mm)			Weight (g)				
Location Name	Set Code	Number of Fish Sampled	Range	Mean	SD	Range	Mean	SD	N	Wt (Kg)
Fish Egg Inlet	1	-	-	-	-	-	-	-	-	-
Kwakshua Channel	2	2	132-150	141	12.73	27.06-49.94	38.5	16.18	2	0.08
Kildidt Sound	4	1	144	-	-	42.80	-	-	1	0.04
Thompson Bay	5	1	143	-	-	41.75	-	-	2	0.08
Meyers Passage	6	-	-	-	-	-	-	-	-	-
Kitasu Bay	7	-	-	-	-	-	-	-	-	-
East Higgins Pass	8	-	-	-	-	-	-	-	-	-
Powell Anchorage	9	-	-	-	-	-	-	-	-	-
Spiller Channel	10	14	132-142	137	3.39	29.07-42.51	38.23	4.47	36	1.31
Hunter Channel	11	3	135-142	138	3.61	26.30-42.76	34.65	8.23	3	0.10
Burke Channel	12	37	131-167	144	9.77	30.74-62.38	41.92	8.98	41	1.69
Dean Channel	13	31	132-160	139	6.21	29.61-58.96	38.06	6.24	57	2.14
Rivers Inlet	14	10	131-145	136	4.81	28.05-42.68	33.94	4.90	69	2.25
TOTALS		99	131-167	140	7.91	26.30-62.38	38.96	7.61	211	7.69

Table 5. Grouping of organisms, by phylum with abbreviations from plankton tows from the 2011 Central Coast juvenile herring survey.

Coelenterata	
COEL	Medusae - *Aequorea victoria*
SIPH	Siphonophores
Ctenophora	
CTEN	Ctenophores
Annelida	
POLY	Polychaetes
Mollusca	
GAST	Prosobranch gastropods
PELE	Pelecypods
Arthropoda	
AMPH	Amphipods
BARN	Barnacle; unknown stage
CLAD	Cladocerans; Podon sp. and Evadne sp.
COPE	Copepods (Table 6 for complete species list)
CRAM	Crab megalopea
CRAZ	Crab zoea
EUPA	Adult euphausiids; mainly *Euphausia pacifica*
EUPL	Larval euphausiids; mainly *Euphausia pacifica*
OSTR	Ostracods
SEAL	Sea lice - *Caligus elongatus*
SHRI	Shrimp zoea
Ectoprocta	
ECTO	Ectoprocts; mostly *Membranipora sp.* larvae (cyphonautes)
Echinodermata	
ECHI	Echinoderm larvae
Chaetognatha	
CHAE	Chaetognaths; mostly *Sagitta sp.*
Chordata	
LARV	Larvaceans; mostly *Oikopluera sp.* and *Fritillaria sp.*
FISHL	Larval fish; unknown species
SALP	Salps
Miscellaneous	
EGGS	Mainly euphausiid eggs, with some teleost eggs

Table 6. Abbreviations for calanoid and cyclopoid copepods identified in plankton samples from the 2011 Central Coast juvenile herring survey.

Calanoid copepods	
ALON	*Acartia longiremis*
CABD	*Centropages abdominalis*
CALA	*Calanus sp.*
CCOL	*Canadacia columbiae*
CMAR	*Calanus marshallae*
CPAC	*Calanus pacificus*
EBUN	*Eucalanus bungii*
EELO	*Eucalanus elongatus*
ELON	*Epilabidocera longipedata*
GVAR	*Gaidius variabilis*
MPAC	*Metridia pacifica*
OBOR	*Oncaea borealis*
PPAR	*Paracalanus parvus*
PSEU	*Pseudocalanus sp.*
SMIN	*Scolecithricella minor*
TDIS	*Tortanus discaudatus*
UCAL	*Unidentified calanoid*
Cyclopoid copepods	
CANG	*Corycaeus anglicus*
OATL	*Oithona atlantica*
OITH	*Oithona sp.*
OSIM	*Oithona similis*

Table 7. Number of zooplankton per set per volume (m^3) of water observed in samples from the 2010 Central Coast juvenile herring survey.

Location	Set Code	Station	Volume	ALON	AMPH	BARN	CABD	CALA	CANG	CCOL	CHAE	CLAD
Fish Egg Inlet	1	3	14.3037	22.37	3.36	30.90	19.30	-	-	-	-	58.17
		4	14.2230	17.16	1.83	4.64	4.22	-	1.69	-	-	16.87
Kwakshua Channel	2	3	12.1896	76.13	0.16	13.29	2.63	39.38	-	-	0.33	2.63
		4	12.8265	104.78	-	17.46	2.49	0.39	-	-	-	4.99
Kildidt Sound	4	3	10.0976	53.87	1.98	34.86	123.59	39.81	-	-	-	9.51
		4	13.4748	13.66	-	7.12	5.94	-	-	-	-	8.91
Thompson Bay	5	1	12.8425	73.51	0.16	-	136.81	7.24	-	-	0.16	12.46
		3	13.7590	34.89	-	-	82.56	0.58	3.49	-	1.16	-
Meyers Pass	6	1	6.2792	594.19	0.64	469.01	409.77	-	-	-	-	652.32
		4	5.1097	394.54	-	551.11	408.24	1.17	-	-	-	563.63
Kitasu Bay	7	1	15.0397	800.02	0.13	17.02	67.22	7.58	-	-	-	-
		2	13.3065	1827.68	0.15	-	515.61	94.47	-	-	-	-
East Higgins Pass	8	2	7.4898	143.13	0.80	2.14	32.04	1.60	-	0.53	-	-
		3	11.9908	330.92	-	0.17	120.09	1.00	-	-	0.17	-
Powell Anchorage	9	3	14.3228	23.46	0.56	146.34	10.75	4.75	-	-	1.12	110.59
		4	14.3936	94.49	-	20.01	3.75	-	-	-	-	16.67
Spiller Channel	10	3	11.7950	127.51	10.85	27.13	-	38.83	-	-	-	27.13
		4	13.1267	35.73	14.70	7.31	-	1.22	-	-	-	9.75
Hunter Channel	11	2	12.8052	63.72	0.08	0.62	138.77	1.17	-	-	-	3.75
		3	12.7998	23.28	12.66	5.31	137.27	6.25	-	-	-	11.25
Burke Channel	12	3	7.7770	156.36	-	16.46	4.11	-	-	-	-	90.52
		4	8.5640	125.18	-	1.87	-	-	-	-	-	28.02
Dean Channel	13	4	13.6242	2.35	1.17	1.17	-	2.13	-	-	-	139.75
		5	13.6767	8.19	2.05	-	-	1.68	-	-	-	73.70
Rivers Inlet	14	2	7.7381	22.74	3.10	10.34	-	2.07	-	-	-	-
		3	7.3153	21.87	0.14	46.48	-	0.41	-	-	2.46	2.19
Totals	13	26	300.8707	5191.72	54.51	1430.77	2225.18	251.73	5.18	0.53	5.39	1842.81

Table 7 continued…

Set Code	Station	CMAR	COEL	CPAC	CRAM	CRAZ	CTEN	EBUN	ECHI	ECTO	EELO	EGGS	ELON
1	3	-	0.98	-	0.07	2.73	3.57	-	-	1.68	-	-	-
	4	-	10.69	0.14	0.42	8.02	0.98	-	1.69	1.12	-	-	-
2	3	43.32	2.87	1.97	-	0.25	0.41	-	-	7.88	-	15.75	-
	4	-	0.55	-	-	4.44	12.40	-	-	1.25	-	17.46	-
4	3	0.40	17.03	2.38	7.53	21.79	-	-	-	-	-	53.87	-
	4	-	7.72	-	5.94	86.68	-	-	-	1.78	-	3.56	-
5	1	0.16	0.47	0.16	0.78	4.20	0.16	-	-	-	-	-	-
	3	-	2.18	-	4.22	56.11	0.58	-	-	1.16	-	-	-
6	1	-	2.87	-	0.32	13.86	-	-	-	30.58	-	30.58	-
	4	-	3.52	-	0.39	53.62	0.39	-	-	25.05	-	37.58	1.17
7	1	0.07	1.13	-	0.47	0.73	0.33	-	-	-	-	825.55	-
	2	-	1.80	-	7.06	2.86	-	-	-	-	-	1693.01	-
8	2	-	0.80	0.53	0.27	0.27	-	-	-	-	-	476.38	-
	3	-	2.34	-	2.50	1.50	-	-	-	16.01	0.33	368.28	-
9	3	-	1.95	-	0.28	22.06	3.91	-	-	1.12	-	86.02	-
	4	-	4.17	-	2.78	76.42	1.39	-	-	-	-	7.78	-
10	3	0.68	5.43	0.34	-	0.34	0.34	-	-	-	0.51	100.38	-
	4	-	2.06	0.53	-	0.23	-	-	-	-	-	15.85	-
11	2	-	1.56	-	0.31	7.50	15.93	-	-	-	-	-	0.31
	3	-	4.53	0.16	0.47	6.88	6.09	-	-	-	-	-	-
12	3	-	16.97	-	-	8.23	8.23	51.31	20.57	4.11	5.53	49.38	-
	4	0.93	5.60	-	-	0.93	20.55	47.88	9.34	5.60	-	46.71	-
13	4	-	51.09	-	-	-	-	9.25	-	-	-	21.14	-
	5	0.29	30.42	-	-	-	-	5.85	-	1.17	-	1.17	-
14	2	0.52	-	-	-	-	-	1.94	-	4.14	1.68	4.14	-
	3	0.14	-	-	-	-	-	1.50	-	10.94	-	35.00	-
Totals		46.49	178.72	6.20	33.80	379.64	75.26	117.72	31.60	113.59	8.05	3889.58	1.49

Table 7 continued...

Set Code	Station	EUPA	EUPL	FISHL	GAST	GVAR	LARV	MPAC	OATL	OBOR	OITH	OSIM	OSTR
1	3	-	25.24	0.07	1.68	-	7.83	-	-	-	-	-	-
	4	-	3.94	0.07	0.56	-	4.50	-	-	-	-	0.56	-
2	3	1.23	4.84	0.16	-	-	7.88	10.25	-	-	-	-	-
	4	-	6.24	-	1.25	-	21.21	-	-	-	-	11.23	-
4	3	0.79	67.74	-	6.34	-	25.35	-	-	-	-	-	-
	4	-	4.75	0.59	2.37	-	8.91	-	-	-	-	2.37	-
5	1	6.23	7.48	-	-	-	-	-	-	1.25	-	3.74	-
	3	-	0.29	-	9.30	-	3.49	-	-	-	-	10.47	-
6	1	-	132.98	-	-	-	101.92	0.16	-	-	-	20.38	-
	4	-	204.32	-	-	-	350.70	-	-	-	-	25.05	-
7	1	-	8.51	0.07	8.51	-	17.02	-	34.04	-	-	17.02	-
	2	-	9.62	0.15	-	-	28.86	-	-	-	-	-	-
8	2	0.80	28.84	-	-	-	2.14	24.57	-	-	-	-	-
	3	0.92	104.41	-	5.34	-	-	1.17	-	-	-	-	-
9	3	0.98	28.21	0.28	1.12	-	29.04	0.28	-	-	-	-	-
	4	-	4.45	-	-	-	5.56	-	-	-	-	-	-
10	3	0.34	4.41	0.34	5.43	-	13.57	22.55	-	-	-	-	-
	4	-	11.20	-	3.66	-	6.09	-	-	-	-	-	-
11	2	-	24.05	-	11.25	-	28.74	-	-	-	1.25	-	-
	3	-	8.91	-	7.50	-	46.25	-	-	-	-	1.25	-
12	3	-	2.06	-	12.34	-	288.03	163.30	4.11	-	-	-	24.69
	4	1.87	14.95	1.87	9.34	-	183.09	-	-	-	-	-	3.74
13	4	-	0.59	-	4.70	-	14.09	-	14.09	-	-	5.87	1.17
	5	-	14.62	-	1.17	-	28.08	40.07	2.34	-	-	14.04	10.82
14	2	6.20	1.03	-	4.14	2.07	-	83.22	2.07	-	-	14.47	24.81
	3	0.14	0.14	-	-	-	0.27	169.10	13.12	-	-	10.94	-
Totals		19.50	723.79	3.60	95.99	2.07	1222.62	514.67	69.78	1.25	1.25	137.39	65.23

Table 7 continued...

Set Code	Station	PELE	POLY	PPAR	PSEU	SALP	SEAL	SHRI	SIPH	SMIN	TDIS	UCAL
1	3	-	-	-	6.43	-	-	2.45	-	-	-	-
	4	-	1.12	-	4.22	-	-	3.94	1.69	-	0.84	-
2	3	-	-	5.25	142.66	-	-	0.16	-	-	-	-
	4	-	-	2.49	3.74	-	-	0.39	0.08	-	-	3.74
4	3	-	3.17	19.01	10.10	-	-	6.34	21.00	-	6.34	-
	4	-	0.59	-	-	-	-	4.16	50.46	-	-	4.16
5	1	-	-	3.74	27.25	-	-	11.37	2.34	-	-	-
	3	-	1.16	-	2.33	0.15	-	10.90	31.11	-	-	-
6	1	-	-	33.60	165.15	-	-	1.75	0.64	-	-	0.32
	4	-	-	31.31	42.66	-	-	5.48	1.17	-	-	-
7	1	-	-	42.55	184.84	-	0.07	0.73	0.86	-	-	-
	2	-	-	96.19	46.14	-	-	11.42	11.57	-	-	-
8	2	-	0.53	-	123.90	-	-	0.53	0.53	-	-	-
	3	-	-	54.71	369.62	-	-	1.50	-	-	-	-
9	3	1.12	1.12	4.05	16.06	-	-	4.75	-	1.12	-	-
	4	-	-	3.89	13.55	-	-	1.95	1.39	-	-	-
10	3	2.71	3.39	9.67	81.14	-	-	1.36	22.38	-	-	-
	4	-	-	-	165.39	-	-	3.50	39.31	-	-	-
11	2	-	-	6.25	1.25	-	-	11.25	-	-	1.25	0.94
	3	-	1.25	1.25	9.53	-	-	9.38	-	-	-	-
12	3	16.46	-	-	61.72	-	-	6.17	8.23	-	-	-
	4	1.87	37.37	-	72.63	-	-	-	0.93	-	-	-
13	4	-	6.75	-	21.51	-	-	-	23.78	-	-	-
	5	1.17	-	-	26.98	-	-	-	7.31	-	-	-
14	2	-	46.52	-	77.54	-	-	-	7.75	-	-	-
	3	-	4.10	-	212.98	-	-	0.41	2.46	8.75	-	-
Totals		23.33	107.09	313.97	1889.32	0.15	0.07	99.88	235.00	9.87	8.43	9.15